RESEARCH REPORT

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PREFACE

This Research Report is to be considered a supplement to the Proceedings of the 1950 meeting of the North Central Weed Control Conference. It represents the combined efforts of 170 cooperators and the 23 members of the Research Committee. It has been possible to assemble and summarize the current information available on weed control only through the close cooperation of all who contributed to this publication. The Chairman wishes to express his gratitude to all those whose assistance, thoughtfulness, and cooperation have made possible the 1950 Research Report.

A valuable feature of this Report is the inclusion of information obtained during the 1950 season so that it will be available for use by other workers during 1951. To assemble and publish current data so promptly requires rigid deadlines. It is regretted that these deadlines prevented some cooperators from presenting part or all of their current data. The limited time available also prevented abstracts and indexes from being checked as thoroughly as is desirable. It is hoped that errors that do occur will not seriously affect the value of the Report.

Three indexes were prepared to enable information to be located more easily. The Project Index lists the pages on which abstracts submitted under various projects and sub-projects may be found. In all cases the project summary immediately precedes the abstracts which it summarizes. The Contributor Index lists all pages on which the contributor is listed as an author or as a co-author of abstracts or summaries. Frequently a contributor may have several abstracts on a single page. Authors may be contacted by addressing them at the station from which the contribution was made. The Weed Index lists pages on which the responses of weedy species to herbicidal treatments are described. In many cases information on the responses of weeds are included in abstracts other than those appearing in sections devoted solely to weed control. This index should be consulted in order to determine where information on a weedy plant may be located. Frequently a species may be cited several times on a single page.

It is the hope of the Research Committee that this Report will be of value to extension workers, regulatory personnel and industrial leaders interested in weed control activities as well as to research workers. If this hope is realized, even to a limited degree, the effort involved will have been justified.

K. P. Buchholtz
Chmn. Research Committee

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Project I. Control of Perennial Herbaceous Weeds.

Canada and perennial sow thistle. A. L. Bakke

Summary

From the reports that have been submitted, it is clear that the Canada thistle and the perennial sow thistle cannot be eradicated with one treatment of any of the 2,4-D compounds. Top growth can be killed but regeneration will occur: generally top growth is decreased in amount and vigor by repeated applications. With repeated applications, the Iowa station found that there was little difference in the formulations. The ester formulation produced more rapid killing of the top growth. Sodium chlorate proved to be the most effective herbicide where small patches are to be eradicated.

Friesen of the Dominion Experimental Station at Scott, Saskatchewan, treated Canada thistles in June 1949 when they were in the pre-bud and bloom stage with amine and ester formulations of 2,4-D and later plowed the ground and kept it black by frequent cultivation until killing frost. The 1950 crop showed less than one percent regrowth. Perennial sow thistle reacted in much the same way. Friesen and Keys were also able to cut the regrowth of perennial sow thistle to one percent when sprayed with an ester formulation at the 3/4 /a. rate when the plants were beginning to elongate.

Legett of the Dominion Experimental Station, Lacombe, Alberta has stressed the matter of control of top growth and seed setting. With 12 oz. of an amine salt per acre, 50 percent of the above-ground growth was killed while with an ester formulation of the same concentration, 90 percent of the top growth was killed. With 8 oz. of the amine, there was a trace of seed setting.

Lee of Indiana applied 2 and 3 lbs. per acre of isopropyl ester, polypropylene glycol butyl ether ester of 2,4-D and 2,4,5-T in June and in August. The June treatment proved to be more effective. Top growth was destroyed by all treatments; 2,4,5-T produced a quicker kill of above-ground growth.

The workers at Minnesota tested 15 herbicides and found that top growth was killed by nearly all the herbicides at 1.5 and 3 lbs. rates. Two low volatile esters and an amine salt of M.C.P. appeared promising.

Pavlychenko at Saskatoon, Saskatchewan, was able to get 90-100 percent kill of tops. The ester formulations generally gave the best results. ACP 904 (ester of M.C.P.) was effective on new growth. He obtained good results spraying Canada thistles growing in brome in the late bloom stage with several American Chemical Paint Company products. ACP 638 (2,4-D acid) was not particularly effective. With Weedone 48, Weed-NO-More and ACP 649, all esters, he got 100 percent top kill of perennial sow thistle.

Slife and Fuelleman of Illinois treated Canada thistle with an isopropyl ester and ACP 648 (low volatile) and found that the isopropyl ester was more effective. The repeated treatments with the 1/16 lb. rate were probably too low.

Willard of Ohio found that soil treated with 120 lbs. per acre NaT.C.A. in late October 1949 had little effect on Canada thistles the following year.

Abstracts of Results of Cooperators

Effect of various herbicides on Canada Thistle. Bakke, A. L. and D. W. Staniforth. Canada thistle plots sprayed twice in 1948, twice in 1949 were examined on July 20, 1950 to determine the effect of various herbicides. It was found thatthere had been a material reduction in the number of plants which had been sprayed with different 2,4-D formulations, but complete eradication had not taken place. There was no material difference in the 2,4-D formulations. Four applications of the sodium or amine salt of 2,4-D at the one lb. rate were as effective as the butyl ester formulation. The butyl ester formulation at the 1/2 lb. rate proved to be practically as effective as the one lb. rate; 2,4,5-T was no better than 2,4-D, and the 1/2 lb/a was as effective as the one lb. rate. The average number of thistle plants, four replications, per sq. rd. ranged from 40-181 while the control plot had 1042 plants. Two applications of a butyl ester formulation of 2,4-D in 1949 showed a count in July 1950 of 220. The thistles in the control were in full bloom while those in the plots treated with 2,4-D were small, few were in bud or blossoming. In another area of about a quarter of an acre in extent where Canada thistles had been treated twice in 1945, twice in 1946 and once in 1947 with 2,4-D compounds, 1000 ppm, there were only 5 small plants remaining on the area on September 29, 1950. Sodium chlorate 4 lbs. on July 3 and one lb. on September 29, 1948 to the sq. rd. eradicated the thistles. Ammate of the same concentration proved to be almost as effective. (Contribution of the Iowa Agricultural Experiment Station.)

Effect of a combination of 2,4-D and tillage on Canada thistle (Cirsium arvense). Friesen, H. A. In June of 1949, the ester and amine of 2,4-D were applied as water solutions at four rates, viz: 1, 2, 3 and 4 pounds of acid equivalent per acre to Canada thistle at two stages of growth, namely: 1) the pre-bud and 2) the bloom stage. Five weeks after treatment, the treated and untreated plots were ploughed and the surface kept black by subsequent shallow tillage until freeze-up in 1949. In the spring of 1950, the plot area was cultivated and sown to spring wheat. Results: Both formulations at each of the rates used resulted in over 95 percent killing of the top growth. Regrowth at the time when the tillage operations were begun was less than 1 percent on any of the treated plots, although some apparently viable root material was found below the depth of tillage. In the 1950 crop season the treated plots showed less than 1 percent regrowth from the roots. Some Canada thistle was found growing from seed, however, these were readily killed by spraying the crop with 1/4 pound of acid per acre (butyl ester). The check plot, which received the tillage, but no 2,4-D, had an estimated 30 percent survival of Canada thistle.

Patches of perennial sow thistle Sonchus arvensis, occurred in the plots receiving the 2 and 3 pound rates of ester. The effect on the sow thistle was essentially the same as that on the Canada thistle. (Contribution of the Dominion Experimental Station, Scott, Sask.)

Effect of 2,4-D on perennial sow thistle (Sonchus arvensis) in spring wheat. Friesen, H. A. and Keys, C. H. The amine and ester formulations were sprayed as water solutions at the rates of, viz: 1/2, 3/4, 1 and 1-1/2 pounds per acre on perennial sow thistle growing in spring wheat. The sprayings were made soon after the thistles had passed out of the rosette stage and were growing rapidly. The wheat crop was an estimated 10 inches tall at the time of the treatments. Moisture and temperature conditions were conducive to rapid growth. Results: All rates and formulations effectively controlled the top growth of the sow thistle until the crop had matured. At harvest time (August 29), the amine at the 1/2, 3/4 and 1 pound per acre rates had 5 percent regrowth, while the amine at 1-1/2 pounds per acre had 3 percent regrowth. The ester at the 1/2 pound per acre rate had 4 percent regrowth while at the 3/4, 1 and 1-1/2 pounds per acre rates, the regrowth was only 1 percent.

The treatments were laid down as strips, one rod in width, with every third strip being an untreated check. Paired square yard samples taken down the length of the strips showed no significant increase or decrease in yield between any one treatment and its corresponding untreated check, with the exception of the amine at 1/2 pound, for which treatment yield data were not available. (Contribution of the Dominion Experimental Station, Scott, Sask.)

The effect of 2,4-dichlorophenoxyacetic acid on Canada thistle (Cirsium arvense) in crop. Leggett, H. W. The butyl ester and triethanolamine formulations were used at the 3 following rates of 2,4-D equivalent per acre: 4, 8 and 12 oz. The plots were sprayed July 21 in a late seeded crop of Larain oats. The thistles were in the rosette to pre-bud stage of growth and the oats were in the late shot blade stage. Growth conditions were very good at the time of spraying. Average results from the sprayed plots are as follows:

1.	4 oz.	amine 10%	topgrowth kill	5 % set seed
2.	"	ester 20%	" "	5 % " "
3.	8 oz.	amine 25%	" "	trace " "
4.	"	ester 30%	" "	none " "
5.	12 oz.	amine 50%	" "	" " "
6.	"	ester 90%	" "	" " "

The Canada thistle plants in all of the plots were affected to a certain degree, but some of the plants in the plots sprayed with 4 oz. of the ester and amine formulations recovered enough to set seed up to 5%. This may be attributed to some of the plants being partially covered by the oats and not receiving enough 2,4-D acid to be lethal. None of the oats appeared to be damaged be any of the treatments. One of the main points to be watched in spraying for control of thistles is that the booms are set high enough to get the spray on the growing tips. Our experience has been that if this is done no seed will set from any of those plants. Similar experiments conducted in previous years show that control of Canada thistle in cereal crops with low rate applications of 2,4-D give similar results. (Contribution of the Dominion Experimental Station, Lacombe, Alberta.)

Relative effectiveness of 2,4-D and 2,4,5-T for control of Canada thistle (Cirsium arvense). Lee, Oliver C. Canada thistle plots were sprayed using an isopropyl ester of 2,4-D, polypropylene glycol butyl ether ester of 2,4-D, and 2,4,5-T with rates of 2 and 3 pounds of acid per acre. Two series of plots were treated, one in June when the plants were in the early bud stage of growth, and the other the first of August. The August treatment was applied to Canada thistles when they had obtained approximately 6 inches of height following clipping in early July. Top growth was destroyed by all treatments. Some resprouting appeared on all plots. Observations made during October indicate the June spraying to be more effective. There appeared to be very little difference in results obtained from the two rates of treatments. 2,4,5-T produced a quicker kill of tops than did the 2,4-D. Estimates percent of kill made on October 12 is as follows: June treatments -- 2,4,5-T, 2 pounds 40, 3 pounds 38; isopropyl ester, 2 pounds 56, 3 pounds 60; and polypropylene glycol butyl ether ester, 2 pounds 68, 3 pounds 66. No attempt was made to estimate the percent of kill of August treatments as most root parts appeared to be alive and many new sprouts starting. (Contribution of the Agricultural Experiment Station, Purdue University.)

A field study on evaluation of herbicides for Canada thistle (Cirsium arvense). Miller, J. H., Heggeness, H. G., and Dunham, R. S. Fifteen selected herbicides were applied at rates o 1.5 pounds and 3 pounds of acid equivalent per acre. Duplicate applications were made on 2 square rod plots at the "shooting stage" of the Canada thistle. Forty gallons of solution were applied per acre. The herbicides included: Maleic hydrazide, disodium 3, 6 endoxyhexahydrophthalate; five 2,4-D formulations, three of which were low volatile esters, one amine salt, and one emulsified acid; three 2,4,5-T formulations of which two were esters and one an amine salt; two, 2,4-D, and 2,4,5-T mixtures, one an ester and one an emulsified acid; three MCP formulations, an ester, an amine salt, and a sodium salt.

Top growth was killed by nearly all the herbicides, however, fall regrowth appeared in varying degrees on all plots. Fall observations indicate two low volatile esters of 2,4,-D; one ester of 2,4,5-T; and an amine salt of MCP to be considerably more promising than the standard used (butoxy ethanol ester of 2,4-D and 2,4,5-T). An emulsified acid of 2,4-D; an amine of 2,4-D; an amine salt of 2,4,5-T; and a mixture of 2,4-D and 2,4,5-T as emulsified acids appeared about equal to the standard. The remaining six herbicides appeared to have little promise for Canada thistle control. The three pound rate appeared somewhat more promising than the 1.5 pound rate. (Joint contribution of the U.S.D.A., Minnesota Agricultural Experiment Station and Minnesota State Department of Agriculture.)

Controlling Canada Thistle (Circium arvense) with 2,4-D. Slife, F. W. and R. F. Fuelleman. Duplicate plots of Canada thistle were treated with Isopropyl ester of 2,4,-D and ACP 648 at 1/16, 1/8, 1/4, 1/2, and 2 pounds of acid per acre. All plots were treated on June 14 and the 1/16 pound plots were retreated each 10 days until five treatments were completed. One-sixteenth pound with repeated treatments prevented the thistles from blooming, but did not kill the top growth completely. The thistle plants on the 1/16 pound rate stopped growth and chlorosis gradually developed. Plots other than the 1/16 pound rate were retreated on August 15. It was quite evident on all these plots that at equal rates, 2,4-D was more effective than ACP 648. (Contribution of the Illinois Agricultural Experiment Station, Urbana, Illinois.)

Results of treating perennial sow thistle (Sonchus arvensis) and Canada thistle (Cirsium arvense) with ACP 904, in the late bloom stage, 1950. Pavlychenko, Thomas K. Plots 16'x16' in size, on partially disturbed prairie sod densely infested with perennial sow thistle and Canada thistle were treated on August 16th with ACP 904 (ester of MCP) at 2 and 4 lbs/a. rates, in oil and in water. Untreated areas were left as checks. In this late treatment, no attempt was made to evaluate the effect of the chemical on the two species separately. Final separate readings on the two species will be taken in 1951. Results: One month after treatment, foliage was 100 pct. dead on both weeds. Stems showed some green at bases, otherwise they were dry. In each plot there was some regrowth. Water spray seemed to be more effective in killing top growth, but oil appeared to be more effective in reducing the amount of new growth. (Contribution of the Agr. Div., American Chemical Paint Company, Saskatoon, Sask.)

Effect of systemic herbicides, including non-commercial laboratory formulations, on perennial sow thistle (Sonchus arvensis) treated in rosette stage, 1950. Pavlychenko, Thomas K. Plots 16'x200' in size, with varying populations of perennial sow thistle, were treated on July 3rd in the rosette stage with Weedone Concentrate 48 (ethyl ester of 2,4-D); Weedar 64 (amine salt of 2,4-D); Weedone LV 4 (butoxy ethanol ester of 2,4-D); Weed-no-more (Butyl ester of 2,4-D); ACP 954 (amine salt of MCP); ACP 638 (2m4-D acid); ACP 649, ACP 648 and ACP 784 (esters of 2,4-D): ACP 646A (2m4-D acetanlide) and ACP 675A (amylamine of 2,4-D) at 1/2 and 1 lb/a rates. ACP 472 (2,4-D acid) was applied at 1 and 2 lb/a rates. Untreated areas were left at the end of each plot as checks. The soil was a dark brown clay loam. Results: A top kill of 100 pct. and no regrowth was obtained at both rates of Weedone Concentrate 48, Weed-no-more and ACP 649. Top kill of 90 pct. or more was produced in 1 lb/a rates of ACP 954, ACP 638, LV 4, Weedar 64, ACP 648 and ACP 646A. ACP 784 gave over 90 pct. top kill at both rates. Both survival and regrowth was significantly lower in 1 lb/a rates as compared with 1/2 lb/a rates. (Contribution of Agr. Div., American Chemical Paint Company, Saskatoon, Sask.)

Effect of various systemic herbicides, including non-commerical laboratory formulations on Canada thistle (Cirsium arvense) treated in rosette stage, 1950. Pavlychenko, Thomas K. On July 3rd, Canada thistle plots 16'x200' in size were treated in the crop of oats at 1/2 and 1 lb/a rates of Weedone Concentrate 48 (ethyl ester of 2,4-D); Weedone LV 4 (butoxyl ethanol ester of 2,4-D); Weedar 64 (amine salt of 2,4-D); ACP 954 (amine salt of MCP) and ACP 648 (ester of 2,4-D). ACP 472 (acid of 2,4-D) was applied at 1 and 2 lb/a. Untreated areas around the plots served as checks. Results: In five weeks after treatments the topgrowth was killed 100 pct. in all plots excepting ACP 472, 1 lb/a and Weedone Concentrate 48, 1/2 lb/a., where 2 and 10 pct. surviving plants were recorded. At this time some plots showed a considerable amount of regrowth. At the end of the growing season final population in terms of the original stand was as follows: ACP 472, 1 lb/a-102 pct; 2 lbs/a-100 pct; ACP 954, 1/2 lb/a-40 pct; 1 lb/a--; Weedone LV 4, ½lb/a--; 1 lb/a-20 pct; Weedar 64, 1/2 lb/a--4pct; 1 lb/a-20 pct; Weedone Concentrate 48, 1/2 lb/a-20 pct, 1 lb/a-4 pct; ACP 648, 1/2 lb/a-200 pct., 1 lb/a 200 pct. (Contribution of Agr. Div., American Chemical Paint Company, Saskatoon, Sask.)

Results of treating Canada thistle (Cirsium arvense) in brome grass sod with systemic herbicides, 1949. Pavlychenko, Thomas K. Plots 16'x40' in size on brome grass sod, densely infested with Canada thistle, were treated in 1949 in the late bloom stage, at rates of 1/2, 1 and 1-1/2 lbs./a. of Weedone Concentrate 48 (ethyl ester of 2,4-D); Weedone Brush Killer 32 (2,4-D and 2,4,5-T in proportion of 2:1); ACP 572 (esters of 2,4-D and 2,4,5-T) in oil and ACP 638 (2m4-D acid). Results: Late in the Fall of 1949, ACP 572 alone gave 60 pct. top kill at 1/2 lb/a. rate. Other chemicals produced from 0 to 25 pct. At 1 lb/a., 10, 50, 80 and 50 pct. were obtained with Weedone Conc. 48, Weedone Brush Killer 32, ACP 572 and ACP 638 respectively. At 1-1/2 lbs/a., the corresponding figures were 25, 85, 100 and 75 pct. In September 1950 the pasture which a year ago was overrun by rank thistles, was once again produced a luxurious stand of brome grass with no thistle in sight. The careful records revealed, however, that occasional plants still remained in each plot. At this time the highest pct. (4.7) of the surviving plants was found in 1-1/2 lbs/a. of ACP 638. In other plots the survival was from 0.1 to 2.9 pct. only. The winter of 1949-50 was very severe and this might have assisted the chemicals in producing these results. (Contribution of Agr. Div., American Chemical Paint Company, Saskatoon, Sask.)

TCA: residual effects. Willard, C. J. Triplicated plots of Canada Thistle, 7'x200', on Miami-Brookston soil were treated in late October, 1949 with 40, 80, and 120 pounds per acre of STCA. There was a barely visible effect on the thistles at the highest rate. The area was planted to corn this year, and no trace of TCA effects could be detected in it.

Paths 2 feet wide were cut in strips of soybeans, to mark out plots in July, 1949, Miami soil, using 50 pounds per acre of TCA plus 1 pound per acre of 2,4-D. The area was replanted to soybeans this year and the paths could be readily traced by the burned crinkled leaf edges typical of TCA injury. The injury had little, if any, effect on yield.

As reported in another abstract, STCA at 90 pounds per acre in September on river bottom sandy loam did not affect corn this year, but 30 pounds per acre May 1 on the same soil killed most of the corn planted 7 weeks later. (Contribution of the Ohio Agricultural Experiment Station.)

Project 1. Use of Herbicides in Control of Perennial Herbaceous Weeds.
Quack Grass

D. E. Kratochvil

Summary

Twenty seven abstracts were written reporting investigations on control of quack grass. The majority of these reported trials of TCA, or combinations of this chemical with cultural treatments.

Methods of application included application of TCA on undisturbed quack grass sod; mowing, then spraying; plowing before spraying; discing before spraying; one-waying before spraying; discing, plowing, or one-waying after spraying; cultivation by one of the above methods - then application of TCA and cultivating at intervals to 6 weeks. One investigator plowed and double-disced the plots in the fall of 1949, double-disced again May, 1950, cultivated, sprayed, and double disced June 9, 1950. Most investigators reported that some form of cultivation increased the effectiveness of TCA applications. Reported data do not clearly establish the most efficient type, or time, of cultivation to use in conjunction with TCA in quack grass control.

Reported rates of application of TCA varied from 10 pounds per acre to 200 pounds per acre. Investigators, who compared chemical treatments alone, to chemical treatments plus cultivation used comparable rates. Results indicate rates of application between 40 and 100 pounds of active acid of TCA per acre necessary to obtain effective control. When cultivation was employed in conjunction with TCA, the lower rates of application in this range, were as effective as rates in the higher levels without benefit of cultivation.

Dates of application ranged from early spring (April) to October. Effective control was reported for applications made during every month of the period indicated above. Several investigators indicated better control with later applications than with spring or early summer.

Weather factors were reported by several investigators. All investigators indicating weather conditions agreed that optimum soil moisture for active growth of quack grass, increased the relative control obtained. Several indicated that optimum soil moisture for active growth may be more important than rates or dates of application.

Several investigators reported on residual effect of TCA on crops. Oats was tolerant of rates of application from 20 to 200 pounds of TCA per acre. Corn planted after applications of 50 pounds or above, was killed. No harmful effects was found on wheat, barley, rye, or flax planted in 1950 on plots treated with 25, 50, 75, 100, 125, 150, 175, or 200 pounds TCA per acre in 1949. Potatoes planted in 1950 on plots treated in 1949 with a total of 40 pounds of TCA per acre showed no reduction in yield; however the plants did not have entirely normal growth. Soybeans planted on plots treated with 10, 20, 40 or 80 pounds TCA per acre produced no crop of consequence on any rate except 10 pounds.

Other chemicals included in work on quack grass were: Chlorosal-A (Pittsburgh Chemical Co.) at 100 and 150 pounds per acre which gave good control when applied August 1, 1950 to quack grass sod; E.H. 2 (dichloral urea - Carbide and Carbon Chemical Co.) at 20, 40 and 80 pounds acid per acre showed little lasting effect; E.H. 5722 (Carbide and Carbon Chemical Co.) at 5, 10, and 20 pounds per acre showed little control; E.C. 3002 (Sharples Chemical Co.) at 8, 16, 24, and 32 pounds acid per acre gave no control; Micronized 2,4-D at 4, 8, 12, and 16 pounds of acid per acre gave no control. Q X S 16 (a petroleum product) at 50 and 100 gallons per acre gave no control; Stoddards solvent at 100 gallons per acre killed the foliage but

regrowth occured; Stoddards solvent plus 10 pounds of PCP per 100 gals. of solvent and Stoddard's solvent plus ammonium DNOSBP 10 pounds per 100 gals of solvent killed the foliage but regrowth occurred. The sodium salt of 2,4-D at 4 pounds per 100 gallons of water, a 2 per cent solution, of KOCN or the sodium salt of PCP at 10 pounds per 100 gallons of water gave no permanent effect. Isopropyl N-phenylcarbonate (IPC) applied at 55, 100, and 400 pounds in August, 1949 gave 75, 100, and 85 per cent control respectively. Maleic hydrazide was used by several investigators. Rates of application varied from 2 to 32 pounds per acre. Only one investigator reported effective control,--that being a 16 pound application. Thirty-two pounds gave no lasting effect on undisturbed quack grass sod.

Investigations reported indicate that TCA appears to be the most promising herbicide for quack grass control. More work is needed to determine the relative importance of seasonal growth, soil type, soil moisture, and pre or post cultivation practices, as factors in the most efficient use of TCA for quack grass control.

ABSTRACTS OF RESULTS OF COOPERATORS

The response of quackgrass to TCA and cultural treatments. Buchholtz, K. P. Square rod plots of a heavy quackgrass sod were treated with the sodium salt of TCA at rates of 0, 25 and 50 lbs. per acre on April 20, 1949. Portions of these treatments were subjected to disking, plowing and no cultural treatments on May 17, 1949. Soil type of the experimental area was Miami silt loam and three replicates were used. Initial infestations were obtained both visually and by taking 5 five-inch plugs from the sod at random within each plot. Rhizomes contained in each plug were separated from the soil and dry weights obtained. Estimates of stand made in October 1949 indicated that the chemical and cultural treatments had complimented each other. Plots treated with 50 lbs. of TCA and either disked or plowed had about 9 percent of the original stand of quackgrass. Use of TCA alone reduced the quack stand to but 55 percent of the original while the one cultivation appeared to have had little effect on the stand. On May 10, 1950 additional plugs were taken from treated plots. Rhizome weights on plots neither cultivated nor treated with TCA were 119 percent of the original. Plots treated with 25 and 50 lbs. of TCA averaged 52 and 19 percent of original rhizome weights. Disked plots treated with 0, 25 and 50 lbs. of TCA averaged 44, 13 and 5 percent of original rhizome weights respectively. Plots plowed after TCA treatment gave rhizome weights of 50, 7 and 3 percent of the original for the 0, 25 and 50 lb. applications. The use of TCA and cultural treatments in combination appear to be much superior to the use of either alone for the control of quackgrass. On May 23 the entire area was sown to Hawkeye soybeans in rows after plowing and fitting. No evidence of residual TCA effects were noted on the soybeans at any time during the growing season. (Department of Agronomy, University of Wisconsin, Madison, Wisconsin.)

Growth of quackgrass, corn and soybeans following TCA applications. Buchholtz, K. P. Plots of dense quackgrass sod, 4 sq. rods in size, were treated on April 3, 1950 with 0, 10, 20, 40 and 80 lbs. per acre of the sodium salt of TCA. Soil on the area was of the Miami silt loam type. Four replications were used and 6.1 inches of rain were received during April and May. On June 2 the entire area was plowed, fitted and planted to single hybrid dent corn (R3 x M13) and Monroe soybeans. Quackgrass shoot counts were obtained on July 5. Plots treated with 0, 10, 20, 40 and 80 lbs. of TCA had 22, 12, 4, 2 and 0.5 shoots per sq. foot, respectively. The soil was distinctly toxic to growth of the corn and soybeans. Corn stands averaged 75, 14, 6 and 0 percent of check respectively, on the plots treated with 10, 20, 40 and 80 lbs. of TCA. Soybean stands were nearly normal on July 5, being 105, 96, 99 and 92 percent of check for the 4 rates of TCA applied. None of the differences were significant. The growth of the soybeans was greatly affected on all treated plots, however, except those receiving the 10 lb. application, and produced no crop of consequence. Plots receiving the 10 lb. application of TCA produced an essentially normal crop of soybeans and no symptoms of TCA toxicity were observed. (Department of Agronomy, University of Wisconsin, Madison, Wisconsin.)

Responses of quackgrass to applications of five herbicides. Buchholtz, K. P. On May 10, 1950, TCA, dichloral urea (E.H. 2), and the sodium salt of alpha-hydroxy b-trichlor ethyl sulfonic acid (Chlorosol-A) were applied at rates of 20, 40 and 80 lbs per acre to a dense quackgrass sod on soil of the Miami silt loam type. Maleic Hydrazide and Herbicide 5722 were applied at rates of 5, 10 and 20 lbs. per acre. All of the chemicals except E.H. 2 were applied in water equivalent to 80 gallons per acre. E.H. 2 was applied as a slurry using 320 gallons of water per acre. The plots were one half sq. rod in size and 4 replicates were used. During May, June and July 21.4 inches of rain were received. At the time of application the quack had made about 5

inches of top growth. On May 17 estimates were made of the extent of leaf kill. TCA applied at 80 lbs. per acre had caused about 45 percent of the leaf tissue to become brown and dry. The 20 lb. application of Herb. 5722 had affected about 20 percent of the leaf tissue and Chlorosol-A when applied at 80 lbs. had affected about 10 percent. Maleic hydrazide and E.H. 2 had caused only minor responses. On July 14 estimates of stand remaining were made. Chlorosol-A, Herb. 5722 and maleic hydrazide had not reduced stands significantly on this date. The 20, 40 and 80 lb. applications of TCA had reduced stands to 75, 48 and 25 percent of check while stands of quack on plots treated with E.H. 2 were 78, 58 and 23 percent of check. Maleic hydrazide at 10 and 20 lbs. per acre had checked growth and reduced heading to less than 10 percent of check on this date. By October 3 recovery had occurred so that the infestations on plots treated with the 20, 40, and 80 lb. applications of TCA and E.H. 2 were up to 95, 93, 58, and 100, 95 and 80 percent of check respectively. Of the materials tested TCA appeared the most promising for quackgrass control. (Department of Agronomy, University of Wisconsin, Madison, Wisconsin)

Treatment of couch grass with TCA alone and in combination with cultural means. Carder, A. C. A continuous infestation of couch (Agropyron repens) on a deep sandy, black loam was treated with TCA at nil, 25, 50, 75 and 100 pounds acetate equivalent per acre. The chemical was applied (1) undisturbed sod, (2) following one-waying 5 inches deep, (3) following double one-waying 5 inches deep, and (4) following one-waying 5 inches deep but preceding a second one-waying. All treatments were made the same day when the couch possessed 4 to 5 inches of leaf growth. Soil moisture was good at time of treatment, but no rain occurred until 5 days later when light showers fell. No substantial precipitation was received until almost 2 months after treatment. Inspection in late summer indicated a 97 percent kill of above-ground parts with the 100-pound rate of the chemical on undisturbed sod. Lesser rates did not show effective killing, being 43, 75 and 75 percent complete with dosages of 25, 50 and 75 pounds per acre, respectively. Where cultural treatment was combined with TCA the effectiveness of the lower rates of the chemical was increased. This trend was most evident where the TCA was applied between the two one-way treatments. Thus 80, 95, 95 and 98 percent of the top growth of the couch was killed when 25, 50, 75 and 100 pounds, respectively, of the active ingredient of the chemical was applied. Cultural treatment alone caused almost no reduction in the stand of couch. The experiment involved autumn treatments but their effectiveness will not be known until 1951. (Contribution of Dominion Experimental Station, Beaverlodge, Alberta.)

The Control of Quack Grass in Nursery Fields with Sodium Tri-chloroacetate (TCA). Chadwick, L. C. and Dickinson, Charles. Approximately 1/4 acre plowed plots were treated June 2, 1950, with TCA at rates of 20, 40, 60 and 80 pounds per acre. Plots were replicated once. Sectional areas of each treated plot and a check plot was disced (1) every 2 weeks, (2) every 4 weeks and (3) once during the summer (Aug.1). One section was not disced. Observations made Sept. 2 showed good control of quack grass in all treated plots regardless of the frequency of discing. (Contribution of the Ohio Agricultural Experiment Station.)

Discing Necessary to Control Weed Growth in Nursery fields Treated with Sodium Tri-chloroacetate (TCA) to Control Quack Grass. Chadwick, L. C. and Dickinson, Charles. Considerable growth of rag weed, horse nettle and thistle occurred in plowed but uncultivated replicated 1/4 acre plots treated with TCA at rates of 20, 40, 60, and 80 pounds per acre to control quack grass. Under conditions of this experiment, applications of 20#-40# per acre of TCA with discing once a month appears to be a logical practice to follow for the control of quack grass and the weeds mentioned. (Contribution of the Ohio Agricultural Experiment Station).

Effects of TCA on couch grass in sod and cultivated land. Corns, W. G. In Experiment I, 20, 40, 80, 160, 240 lb. rates Dow TCA acid equiv. per acre were applied in triplicate to uncultivated mixed brome, Kentucky Blue and couch grass sod and to couch grass in adjacent land cultivated in 1949 and immediately after chemical treatment in 1950. The 160 and 240 lb. rates were sprayed at 300 gal. water per acre and the others at 100 gal. per acre on May 8 when grasses were vegetative. In Experiment II, 75 and 150 lb. acid equiv. per acre were sprayed at 150 gal. acre on July 20 on flowering couch grass in sod. In Experiment III, 45, 65, 75, 85, 95, 105 lb. acid equiv. per acre were sprayed at 100 gal. acre on Aug. 3 on couch grass in a hay field and on adjacent land plowed and disced 3 days earlier. Results from Experiment I show little response from rates lower than 80 lb. Brome was somewhat more resistant than the other grasses. Two highest rates killed sod top growth almost completely. Red root pigweed thrived within 2 months after treatment. In Experiment II the high rate caused complete top kill. Some roots were apparently still viable. Red root became abundant in September. Experiment III appeared to be the most successful. Final 1950 regrowth ranged from about 5% to 1% in all areas but surprisingly there was no marked difference between rates. Additional observations are required in 1951. (Contrib. Dept. Plant Science, Univ. Alberta, Edmonton.)

The effect of herbicides on couch grass. Foster, J. Roe. Four chemicals were applied to well established stands of couch grass (Agropyron repens) in August, 1949. The chemicals used were Trichloroacetate (T.C.A.), isopropyl N-phenylcarbamate (I.P.C.), Alpha-hydroxy, beta trichlor ethyl sulfonic acid (Chlorosol A), and a petroleum product designated as QXS16. Observations made June 12, 1950 showed that 100 pounds of I.P.C., Chlorosol A, and T.C.A. killed the couch grass 100%. Uniform application was necessary for a complete kill. Comparative rates of application under 100 pounds per acre are not available, but 80 pounds of T.C.A. gave 100% kill, while 55 lbs. of Chlorosol A gave a 75% kill. The petroleum product was not effective in controlling couch grass when applied at 50 or 100 gallons per acre. (Contributed by the Dominion Department of Agriculture, Experiment Farms Service, Dominion Experimental Sub-Station, Regina, Saskatchewan, Canada.)

Effect of sodium TCA on quack grass (Agropyron repens) in Ajax oats. Friesen, H. A. 90 percent sodium TCA was applied on June 29 as a water spray at three rates, viz: 20, 40 and 80 pounds of acid equivalent per acre to quack grass patches on land that had been cultivated and sown to oats. Each of the rates used gave a complete top growth kill of the quack grass. Regrowth on the 20, 40 and 80 pounds per acre rates was 80, 30 and 10 percent respectively of the original stand. The oats did not appear to suffer any reduction in vigor or malformations as results of the 20 and 40 pound TCA applications. The 80 pound rate caused a reduction in vigor and a slight stunting of growth. However, the oats recovered and matured plump, healthy appearing seeds. (Contributed by the Dominion Experimental Station, Scott, Sask.)

Effect of sodium TCA on quack grass (Agropyron repens). Friesen, H. A. Uhdisturbed quack grass patches, on land which had been seeded down to crested wheat grass in 1948, were divided into square rod plots and sprayed on June 26 with TCA at 5 rates, viz: 20, 40, 80, 100 and 160 pounds of acid equivalent per acre. Just prior to spraying the plots were mowed and raked. At the 20 and 40 pound per acre rates, considerable regrowth appeared in late July but in August most of the regrowth had turned yellow and some had died. By mid October on the 20 pound rate the number of healthy green shoots was 70 percent, while on the 40 pound per acre rate it was 35 percent. The 80 pound rate had considerable regrowth in July, which turned yellow in August. After mid October the healthy regrowth was only 6 percent of the original stand. On the 100 and 160 pound per acre rates regrowth did not appear during July or August; by mid October it was less than 2 percent for either rate used. Crested

wheat grass plants on the plot margins were killed and showed no signs of recovery by mid October, at all rates used. A portion of the sod in the center of each of the plots sprayed at the rates of 20, 40 and 80 pounds per acre was turned over with a spade. Regrowth in October on the plots treated at 40 and 80 pounds was less than 1 percent while on the plot treated at the 20 pound rate it was 20 percent. (Contributed by the Dominion Experimental Station, Scott, Sask.)

Effect of sodium TCA and tillage on quack grass (Agropyron repens). Friesen, H. A. Quack grass sod, broken in April of 1950, was divided into square rod plots; on June 26, after the quack had resumed growth and was nearing the heading stage, the following treatments were applied. 1. Plowed and sprayed, 2. Plowed, sprayed and hoed 2 weeks after being sprayed, 3. Sprayed and plowed immediately after spraying. Three rates of TCA, viz: 20, 40 and 80 pounds of acid equivalent per acre were applied with each treatment, thus making a total of 9 treated plots. Regrowth began appearing in late July on all plots treated at the rate of 20 pounds per acre. However, the regrowth had a weak, sickly appearance and much of it died in August. By mid October in treatments 1 and 2, the amount of healthy, green shoots did not exceed 25 percent of the original stand. In treatment 3, (spray, plow), the regrowth in October was 60 percent of the original stand. At the 40 pound per acre rate, regrowth did not begin appearing until August. The regrowth of quack was very light on each of these plots, indeed, by mid October it did not exceed 5 percent of the original stand. The 80 pound per acre rate gave the most promising kills; the regrowth on these plots by mid October consisted of only a few scattered shoots i.e., less than one percent. The plots were on a medium loam soil and the moisture conditions were very good throughout the season. (Contributed by the Dominion Experimental Station, Scott, Sask.)

TCA for the control of quack grass in potatoes. Grigsby, B. H. TCA, at 40 lbs. per acre, was applied to quack grass sod in 1949 and 1950. The entire area was planted to potatoes in 1950. The 1949 treatments were divided, 20 lbs. in July, 20 lbs. on the same plots in October, and a series of plots received 40 lbs. in October. In 1950 all treatments were made in May but half of each plot was plowed to expose the rhizomes just before spraying. The TCA was applied as a water spray and as an oil emulsion. Potatoes (Katahdin) were planted in June and made nearly normal growth throughout the season. A few plants developed crinkled leaves but tuber set and growth was equal to the check plots. The plots treated with TCA in 1949 appeared to be free of quack grass in the spring but by midseason they had as much quack grass as the untreated plots. All plots treated in 1950 were free from grass during the growing season. No living rhizomes were present in plots where the rhizomes were plowed up prior to spraying. A few living rhizomes were found in the plots where TCA was applied to the unbroken sod. No hand hoeing was required in the spring treated plots and the area was weed free at harvest time. (Contribution from Michigan Agricultural Experiment Station).

Treatment of quack grass (Agropyron repens) with TCA at four rates at Brookings, South Dakota 1949-1950. D. E. Kratochvil, James Hay, Lyle A. Derscheid and L. M. Stahler. Sodium trichloroacetate at rates of 50, 75, 100 and 125 pounds acid per acre was applied to vigorously growing quack grass in early summer of 1949. The quack was heading. Counts made by estimation of percent elimination October 10, 1949 showed 50 pounds - 36.1%, 75 lbs. - 68%, 100 lbs. - 74%, and 125 lbs. - 90%. Counts taken June 15, 1950 showed 50-lbs. - 10%, 75 lbs. - 20%, 100 lbs. - 40%, and 125 pounds 60%. On this date three replications were treated with original rates of TCA. Estimates of percent elimination October 5, 1950 showed 50 lbs. - 0%, 75 lbs. - 0%, 100 lbs. - 10% and 125 lbs. - 60%. After retreatments of the quack grass there was less control in all cases. Quack grass in plots of the highest rates of application

appeared to be more healthy and were growing more vigorously than on the lower rates. (Contributed by the Agronomy Department of the South Dakota Experiment Station and the Bureau of Plant Industry, Soils, and Agricultural Engineering, U.S.D.A.)

The effect of TCA and two other chemicals plus fertilizer on quack grass (Agropyron repens) at Brookings, South Dakota, 1950. Kratochvil, D. E., James Hay, Lyle Derscheid, and L. M. Stahler. Duplicate 12 foot by 60 foot plots were laid out in a well established quack grass sod on June 12, 1950 and treated with TCA, at 10, 20 and 40 pounds of acid per acre; 2,4-D in the micronized acid form at 4 and 8 pound. 3, 6 endoxo hexahydrophthalic acid (E.C. 3002) at 8 and 16 pounds acid per acre, and IPC at 8 and 16 pounds per acre. The chemicals were mixed with enough ammonium nitrate fertilizer for an application of 100# of nitrogen per acre. This mixture was placed in a fertilizer attachment on a Ford tractor plow and plots were plowed about four inches deep. The fertilizer, plus the chemical, was placed on the plow sole. On July 15, 1950, an area 12 feet by 16 feet of each plot was surface treated with 40 pounds per acre of TCA on all TCA plots, 8 pounds of 2,4-D on all 2,4-D plots, 16 pounds of E.C. 3002 on all E.C. 3002 plots and 16 pounds of IPC on all IPC plots. Estimations of percent control were taken September 15, 1950. TCA at 40 pounds plus fertilizer with no surface treatment gave 35% control, at 20 pounds - 20 percent, and 10 pounds - 16 percent. TCA at the rate of 40 pounds below plus 40 pounds above gave 90 percent control; 20 pounds below plus 40 pounds above gave 90%; 10 pounds below plus 40 above gave 85% percent elimination. Little rain was received on the plots after the initial treatment until late fall. (Contributed by the Agronomy Department of the South Dakota Experiment Station and the Bureau of Plant Industry Soils, and Agricultural Engineering, U.S.D.A.)

Effect of TCA and maleic hydrazide on quack grass (Agropyrons repens). Lee, Oliver C., and Oyer, E. B. Replicated plots, one half sq. rd. in size, were staked out in a clover-timothy field which was heavily infested with quack grass. The soil (a sandy loam) was at a medium moisture level at the time of the first treatment on June 27. Since the quack grass was 3-4 feet high at this time, and many plants had already formed seedheads, the area was clipped before the chemicals were applied in order to insure more uniform coverage. Both chemicals were diluted with water and applied at the rate of 160 gal./A. TCA was applied at 30, 60 and 90 lbs. of the pure sodium salt per acre, and maleic hydrazide was applied at 8, 12 and 30 lbs. of the active ingredient per acre. One set of plots was clipped and another series cultivated four times during the summer. All rates of TCA gave excellent control of quack (95-100 percent kill) until October 10 when some regrowth from crowns and rhizomes was noted. Proportionally more regrowth appeared on plots treated with 30 lbs./A. than on plots receiving 60 and 90 lbs./A. Live rhizomes were found under all plots. Maleic hydrazide gave no control at 8 lbs./A., it reduced stand of quack by approximately 1/4 at 12 lbs., and 3/4 at 30 lbs./A. Growth of plants treated with 30 lbs. maleic hydrazide was severely inhibited. On August 8 the plots receiving 8 and 12 lbs. maleic hydrazide per acre were retreated. This time the herbicide was applied directly to the foliage which was about 1 foot in height. This second application gave no better results than the first spraying. Live rhizomes remained under all treated plots. On August 25 half of the cultivated plots were sprayed with TCA at 20 lbs./A. following the cultivation. By October 10 there was no regrowth on this half of plots. Observations will be made next spring to determine the amount of rhizome kill secured by all treatments. (Contribution of Agricultural Experiment Station, Purdue University.)

The effect of trichloroacetate (TCA) on Couch grass (Agropyron repens). Leggett, H. W. TCA was used on Couch grass sod which was plowed in the fall of 1949 and worked down with a tandem disc. In May of 1950 this area was double-disced, and on June 9th was cultivated, sprayed and double-disced. The TCA was sprayed on square

rod plots, replicated 4 times at 25, 50, 75 and 100 lbs. per acre using 80 gal. of water per acre. The precipitation during the period from the time the plot area was plowed to the time it was treated with TCA was 5.61 inches. This precipitation was approximately 3 inches below normal for that period. The treated plots showed good kills of Couch grass when compared to the check plots, and annual weeds such as Lambs Quarters Pigweed (Chenopodium album) and Stinkweed (Thalpsi arvense) were also inhibited. The average percentage kill of Couch grass and inhibition of annual weeds as compared to the check plots was as follows: 25# TCA killed 71.3% of the Couch grass, and inhibited the growth of annual weeds 50%; 50# TCA killed 81.3% of the Couch grass, and inhibited the growth of annual weeds 65%; 75# TCA killed 90.0% of the Couch grass and inhibited the growth of annual weeds 85%; 100# TCA killed 93.8% of the Couch grass. and inhibited the growth of annual weeds 90%. Combined spraying with TCA and cultural treatments for the control of Couch grass appears promising even with low rate applications. (Contribution of the Dominion Experimental Station, Lacombe, Alberta.)

Treatment of quack grass with TCA in 1949 at six locations in Minnesota, South Dakota and North Dakota. MacDonald, W. P., Zinter, C. C., Slough, A. T. 90% sodium TCA was applied between October 6 and October 30, 1949 at four locations in Minnesota, one in South Dakota and one in North Dakota. Rates of application were 20, 40, 60 and 80 lbs. of acid equivalent per acre. Three replications at each rate, plots randomized. Chemical was dissolved in water and all plots sprayed at the rate of 25 gallons of solution per acre. All plot areas completely covered with quack sod, undisturbed for at least two years. Immediately prior to treatment, one-half of the plot area was plowed and disked down. Percentage of control obtained was estimated several times during the summer of 1950. Final reading was on August 9. Without plowing, control was not satisfactory. Where the land was worked prior to spraying the following average kill for the entire series of plots was noted: 20 lbs., 70% kill; 40 lbs., 82%; 60 lbs., 86%; 80 lbs., 92%. Several individual plots at the two higher rates showed kills of 100%. (Contribution of Agr. Dept., F. H. Peavey & Co., Minneapolis, Minnesota.)

Effect of ACP Grass Killer (TCA 90%) on quack grass (Agropyron repens) sprayed on foliage at the heading stage, July 28th 1950. Pavlychenko, Thomas K. Plots 8x12 ft. in size were laid out on a solid sod of quack grass and treated with ACP Grass Killer (TCA 90%) at the heading stage, with rates of 25, 50, 75, 100, 125 and 150 lbs. per acre on July 28th 1950. The weed grew on a silty clay loam soil. Moisture conditions were very favorable and therefore the stand before treatment was dense and vigorous. In all cases the required quantity of chemicals was sprayed in a sufficient amount of water to produce a good foliage cover. No other treatment was given to the plots in 1950. RESULTS: Records taken at the end of the growing season gave the following readings for different rates: 100% top kill for all rates above 50 lbs. per acre. Survival or regrowth in the 25 and 50 lbs. per acre plots was 13% and 9% respectively. These results are preliminary and only 1951 season's records will determine the degree of effectiveness of each rate. (Contributed by Agr. Div., American Chemical Paint Company, Saskatoon, Sask.)

Response of quack grass (Agropyron repens) to ACP Grass Killer (TCA) treatment, 1949. Results taken in 1949 and 1950. Pavlychenko, Thomas K. This experiment was started in 1949 and the results for that growing season were reported on Page 48 of the 1949 Research Report of the N.C.S.W.C.C. The solid sod of quack grass grew on silty clay loam at Saskatoon. Plots 8x12 ft. in size were treated on July 11th 1949. The effects were recorded in 1949 and 1950. RESULTS: In Plots treated at rates of 25 to 100 lbs. per acre inclusive, some survival or regrowth was usually present by the end of 1949 growing season. This amounted to 20, 8, 3 and 1 pct. in the 25, 50, 75 and 100 lbs. per acre rates respectively. The higher rates resulted in 100% top

kill and no regrowth in 1949. In 1950 there was a noticeable increase in the stand of all plots excepting 200 lbs. per acre rate which remained free of quack grass. The increased infestation was due partly to the additional sprouts arizing from the rhizomes which were damaged but not killed in 1949, and partly to new seedlings developing during the 1950 season. The final stand in 1950 was as follows: 80, 50, 35, 20, 10, 5, 5 and 0 pct. in plots treated at 25, 50, 75, 100, 125, 150, 175 and 200 lbs per acre rates respectively. Under conditions of Central Saskatchewan it is reasonable to state that this chemical gives an appreciable control of quack grass at rates between 75 and 100 lbs. per acre, and results in virtual eradication at rates in excess of 100 lbs. per acre. (Contributed by Agr. Div., American Chemical Paint Company, Saskatoon, Sask.)

A study of the residual effect of TCA on soil, 1949-1950. Pavlychenko, Thomas K. A project for determining the residual effect of TCA on soil was started in 1949 and carried on for a period of two growing seasons. Plots 8x12 ft. on the silty clay loam at Saskatoon, heavily infested with quack grass (Agropyron repens) were treated at 25, 50, 75, 100, 125, 150, 175 and 200 lbs. per acre rates of TCA in July 1949. In the spring of 1950, three rows of each, wheat, oats, barley, rye and flax were sown across the entire project. This was done to determine the degree of soil sterility, if any, in the plots treated at the above rates of TCA in 1949. Results: At the end of 1950, the plots treated with 200, 175, 150 and 125 lbs/acre of TCA in 1949 remained entirely free of original quack grass plants but some new seedlings were present (0 to 10 pct. of the original stand). In rates below 100 lbs per acre the surviving plants, together with new seedlings, were spreading rapidly. The grain crops and flax sown across all these treatments in 1950 have germinated and developed normally and the chemical caused no harmful effects, even on plots treated at 200 lbs. per acre. (Contributed by Agr. Div., American Chemical Paint Company, Saskatoon, Sask.)

TCA on quackgrass. Peters, R. A., and Willard, C. J. At Wooster, Ohio, TCA (sodium salt) was applied in a Latin square design (5 replications) at 0, 10, 25, 50 and 100 pounds per acre to quackgrass sod April 22, before plowing for corn. The area was later plowed, and planted to corn May 20. The quack and corn were both killed at the two highest rates, damaged at 25 pounds, not greatly affected at 10 pounds. STCA applied May 20 at 50 pounds per acre on a heavy quackgrass sod gave complete kill by late summer. STCA was applied to quadruplicated 14' x 14' plots of quackgrass in alfalfa on July 18 at rates of 25, 50 and 100 pounds per acre gave control at all rates. Alfalfa injured but not killed. Next spring's observations necessary for final effect on both plants. (Contribution of the Ohio Agricultural Experiment Station.)

Control of quack grass with TCA and maleic hydrazide. Slife, F. W. and R. F. Fuelleman. Applications of 40, 53, and 80 pounds of TCA per acre were applied to closely mowed quack grass on June 15. Duplicate plots receiving the same rate of TCA were thoroughly disked immediately after spraying. The soil in the plots was a black silt loam. Rainfall during the summer was normal but temperature was below normal. Observations in late September showed regrowth of quack grass on the 40 and 53 pound closely mowed plots. TCA at 80 pounds per acre to closely mowed quack prevented regrowth all season but some of the rhizomes were alive. There was no regrowth on the plots treated with TCA and combined with cultural treatment. Examination of the root system showed a few live rhizomes on the 40 pound rate plot, but no live roots could be found on either the 53 or 80 pound rate plots. Maleic hydrazide was applied to the foliage of quack grass at 16 and 32 pounds per acre of active ingredient on June 15. Both rates stunted the quack grass for 3 months but it began to recover after that time. At 32 pounds per acre there was some reduction in stand

of the quack grass, but these rates were not effective as an eradication measure. (Contribution of the Illinois Agricultural Experiment Station, Urbana, Illinois.)

Effect of several tillage treatments in combination with Sodium TCA in controlling quackgrass (Agropyron repens). Watson, A. J. The effect of several tillage treatments used in combination with Sodium TCA in controlling quackgrass was studied at seven locations in the vicinity of South Haven, Michigan during the summer of 1950. Tillage treatments included (1) plowed and disked immediately prior to spraying, (2) disked prior to spraying (3) disked following spraying (4) plowed and disked 1 month after spraying, (5) plowed and disked, waited 4 weeks for regrowth, disked and sprayed, and (6) no tillage. Rates of Sodium TCA used within each tillage block were 10, 20, 40, 60, and 80 lbs. acid equivalent per acre. Soil textures varied from sand, sandy loam, to loam soils. Rainfall was characterized throughout the summer by heavy rains followed by 3 to 6 weeks of dry weather. Plowing with a moldboard plow prior to TCA treatments greatly enhanced the effectiveness of the chemical and proved to be the most effective tillage treatment used. The 40 lb. rate applied in May after plowing resulted in practical control (95 to 98% reduction in stand) as observed in October. Under similar conditions the 80 lb. rate without tillage failed to give permanent control. Disking without plowing either before or after spraying was only slightly better than no tillage. Plowing one month after spraying resulted in erratic control not consistent between locations. Areas plowed and disked, allowed to regrow a month, disked and sprayed resulted in nearly as good control of quack as where it was sprayed immediately after plowing. (Contribution from the Dow Chemical Company, South Haven, Michigan)

Effect of soil moisture following application of Sodium TCA on the control of quackgrass (Agropyron repens). Watson, A. J. Field experiments with Sodium TCA on quackgrass were conducted in which quack was sprayed both with and without tillage at several locations throughout the summer of 1950. Rates of Sodium TCA used were 10, 20, 40, 60, and 80 lb. acid equivalent per acre. A direct correlation was observed between rainfall following spraying and degree of quack control. At one location on sandy soil good control was obtained by the use of 40 lb. acid equivalent per acre where applied to moist soil June 7 after plowing and disking. An adjoining area was treated similarly on July 24 under dry conditions with practically no control even with 80 lb. per acre. An inch of rain fell within a week after spraying on June 7 while practically no rain fell within 6 weeks following the later treatment. Sufficient rainfall following the application of TCA to get the material into the root zone was essential for effective control of quack. On areas which were plowed prior to treatment and adequate rain for good crop growth followed, very little regrowth of quack was present in October 1950 where 40 lbs. or more per acre was applied. However, dormant and apparently viable roots were present in all plots even though 3 to 5½ months had elapsed since treating and final evaluation must be based on the amount of regrowth in 1951. (Contribution from the Dow Chemical Co., South Haven, Michigan')

Eradicating quack or couch grass with sodium trichloroacetate, (TCA). Wood, H. E., Bourns, J. J., Mather, H. J. Trials commenced in 1949 were continued in 1950, in Winnipeg, at the same location, in the use of TCA to eradicate a dense stand of quack grass on heavy clay soil. Dosages ranged from 30 to 150 pounds acid per acre; treatments early spring, mid-summer, and early fall, except that in 1950 only mid-summer treatments were made. Application was by knapsack spraying at the rate of 80 imperial gallons water per acre. One series of plots was mown, the other not; plots were not cultivated before or following treatment. The following conclusions based, in the main, on the 1949 treated plots were: 1. While 80 pounds per acre or less gave a measure of control, 100 pounds and more gave almost complete eradication.

2. Very moist soil met with in 1950, as opposed to rather the opposite in 1949, would indicate moisture may be of greater significance within the range of applications used than actual rate or date of application. (Contribution of the Weeds Commission, Manitoba Department of Agriculture, Winnipeg, Canada.)

Effect of maleic hydrazide on quack grass (Agropyron repends) in Dakota flax. Friesen, H. A. A water solution of the amine salt having 30 percent maleic hydrazide (with no wetting agent) was sprayed at three rates, viz: 2, 4 and 16 pounds of acid equivalent per acre on square rod plots of quack grass, on June 30, 1950. The quack grass was just coming into the "headed" stage at the time of treatment. The plots were on medium loam soil and on land that had been spring cultivated and sown to flax. These plots also had a light infestation of brome grass B. inermis, Russian thistle S. kali, stinkweed T. arvense, and lamb's quarters C album. The annual weeds were in the early bud stage. The 2 pound per acre rate arrested the growth of the quack grass and by July 12, the plants had turned purple in color. These plants did not appear to recover and produce seed in 1950. However, healthy green regrowth from the roots by mid August was as abundant as the original stand. Russian thistle and stinkweed showed signs of injury on July 4 and by mid August they had died. There was little visible effect on the flax plants while the possible effect on seed setting was obliterated by frost on August 15. Brome grass did not occur on this plot. The 4 pound rate gave essentially the same results as the 2 pound rate with the exception that regrowth of the quack was delayed until after mid September. The effect on the brome was slight, although some of the leaves turned purple in late July. At the 16 pound rate the quack and brome plants turned purple on July 4 and were apparently dead by August. Regrowth was limited to a few shoots of quack which appeared late in September. The annual weeds and flax on July 12 had developed a purple color with greatly swollen leaves and stems and in early August these plants were completely dead. Observations of interest were the slow action of the chemical and its short residual effect in the soil as measured by the abundant emergence in mid August and normal growth thereafter of stinkweed, Russian thistle and blue burr. (Contributed by the Dominion Experimental Station, Scott, Sask.)

Chemical control of quack grass (Agropyron repens). Taylor, Clifford E. Quackgrass growing in a silty clay-loam soil was treated on July 3, when the quack grass was two feet tall. At the time of treatment it was sunny, with a 72° F. temperature. For the week prior to treatments the mean temperature was 66° F. and the rainfall: 6/29 - 0.14" and 7/2 - 0.03". For the week following treatments the mean temperature was 70° F. and the rainfall: 7/5 - 0.03". Treatments were applied to thoroughly wet the quack grass foliage. Stoddard solvent alone, or fortified with PCP at 10 pounds per 100 gallons solvent or NH_4-DNOSBP at 10 pounds per 100 gallons solvent all killed the quack grass foliage, but regrowth occurred later in the summer. Na - 2,4-D at 4 pounds per 100 gallons water caused some yellowing and stunting of the quack grass foliage. KOCN in water at 2% and Na-PCP at 10 pounds per 100 gallons water were ineffective. (Contribution of the Illinois Agricultural Experiment Station, Urbana, Illinois.)

Project I. Control of Herbaceous Perennial Weeds.

Johnson and Bermuda Grass

R. F. Fuelleman

Summary

Only a part of the North Central Region is seriously affected by Johnson and Bermuda grasses. In Ohio, Indiana, Illinois and Missouri, the serious infestations of Johnson grass occur along streams and rivers. Often this means that some of the more fertile land is affected. The problem is complicated by high water, which often makes proper cultivation impossible. During 1950, excessive rainfall and inability to use cultivation gave Johnson grass a start that could not be overcome. As a result the control of Johnson grass in affected states is a serious problem. It is aggravated by the fact that although the actual acreage involved is not large it affects some of the more fertile land in the general area of the lower Ohio, Mississippi, Wabash and Arkansas river basins.

Some 10 abstracts were received. All reported work on Johnson grass. None were received for Bermuda grass. The principal points emphasized in the abstracts were as follows:

1. The time of application is more important than was previously conceded. Also control on the lighter soil types is more easily accomplished.

2. Pre-emergence treatments with large doses of 2,4-D will prevent seedling emergence, but will not prevent regrowth from rhizomes.

3. Heavy applications of TCA, polybor-chlorate, and sodium chlorate will eradicate Johnson grass, but the residual effect on succeeding crops may be serious.

4. Cultural practices plus moderate applications of TCA when rhizomes are beginning to put forth new spring growth are promising.

5. Good control, but not eradication, is possible through the use of moderate dosages of TCA made in the spring and followed by grazing cattle or sheep.

Abstracts of Results of Cooperators

The use of sodium TCA to eradicate Johnson grass. Hamilton, Roger D. and H. E. Rea. Square rod plots of Johnson grass were sprayed with 1/4, 1/2, 1, and 2 pounds of sodium TCA acid on June 15, 1950. The grass was 6-14 inches high, with approximately 25 percent headed. Eradication of 95, 96, 98, and 98 percent, respectively, was obtained. Some 14 inches of rainfall were received in the three months which followed application. At the end of this period, these plots were infested with seedlings. (Contribution of the Amarillo Conservation Experiment Station, Amarillo, Texas.)

The use of polybor-chlorate to eradicate Johnson grass. Hamilton, Roger D. and H. E. Rea. Square rod plots of Johnson grass were sprayed with 3, 4, 5, and 6 pounds of polybor-chlorate on June 15, 1950. Another plot was treated with 6 pounds of polybor-chlorate, which was applied dry, on the same date. Johnson grass was 6-14 inches tall, with approximately 25 percent of the plants headed. Results were 60, 75, 93, and 95 percent eradication for the sprayed plots. Eradication on the plot where the polybor-chlorate was applied dry was 97 percent. Plants remaining on the plots are discolored and stunted. Approximately 14 inches of rainfall were received in the three months following application of the polybor-chlorate. No seedlings have

been noted on the plots to date. (Contribution of the Amarillo Conservation Experiment Station, Amarillo, Texas.)

The effect of TCA on Johnson grass when applied to the mowed stubble with 6-8 inch regrowth. Hamilton, Roger D. and H. E. Rea. Duplicate plots of 5/8, 1, and 2 pounds of TCA acid were applied to Johnson grass stubble which had a regrowth of 6 to 8 inches on August 26, 1949. Plots were located along roadside. All rates gave a 100 percent eradication of the Johnson grass by May 1950. The months from October 1949 to May 1950 were very dry, with less than 2 1/2 inches of rainfall. More than average rainfall fell during the month of June. All plots were reinfested with Johnson grass seedlings and Kochia by June 15, 1950. (Contribution of the Amarillo Conservation Experiment Station, Amarillo, Texas.)

The effect of TCA on Johnson grass when applied in the fall of the year. Hamilton, Roger D. and H. E. Rea. Duplicate square-rod plots of 10, 25, 50, 75, 100, 125, and 150 pounds of TCA acid per acre were made on October 13, 1949. The plots were located along the roadside. Results obtained were 25, 88, 98, 99, 100, and 100 percent eradication, respectively. The rainfall for the period from October 1949 to May 1950 was far below normal, with a total of only 2 1/2 inches during this period. Johnson grass seedlings, Kochia, and pigweed were established in these plots by June 15, 1950. (Contribution of the Amarillo Conservation Experiment Station, Amarillo, Texas.)

The effects of polybor-chlorate on Johnson grass when applied in the fall of the year. Hamilton, Roger D. and H. E. Rea. Square-rod plots of Johnson grass were treated with 4, 6, and 8 pounds of polybor-chlorate on October 13, 1949. The Johnson grass was 12 to 18 inches tall. The chemical was applied as a spray, with 1 1/2 pounds of material per gallon of water. Results obtained were 60, 90, and 95 percent eradication, respectively. The period from October 1949 to May 1950 was very dry, with a total of 2 1/2 inches of rainfall. More than average rainfall was obtained in June, July and September 1950. The Johnson grass on these plots still shows discoloration and deformed leaves. (Contribution of the Amarillo Conservation Experiment Station, Amarillo, Texas.)

The response of Johnson grass to chemicals applied to the soil during winter months. McCall, G. L., D. W. Rake, and J. W. Zahnley. An area of ground solidly infested with Johnson grass, the tops of which had been killed by frost, was chemically treated on November 7, 1949. The infested area was on creek bottom land of a light sandy loam texture. Treatments used were polybor-chlorate at 480, 640, 800, and 960 pounds per acre, Trichloroacetic acid as the sodium and calcium salts at 50, 100 and 200 pounds per acre and Carbide and Carbon Experimental Herbicide #2 at 100 pounds per acre. Additional treatments were applied on January 1, 1950, using polybor-chlorate at 480 pounds per acre and trichloroacetic acid as the sodium and calcium salts at 100 pounds per acre. Corn, Atlas sorghum, soybeans and sweet clover were planted in all plots the first week in June in order to determine the amount of residual toxicity in the treated areas. Data indicate that the rhizomes of established plants treated during the winter were killed by dosages of 800 pounds per acre of polybor-chlorate, by 50 pounds per acre of trichloroacetic acid as the sodium of calcium salt, and by 100 pounds per acre of Experimental Herbicide #2. In general the polybor-chlorate at 800 pounds per acre was more effective for preventing the establishment of seedlings than was Experimental Herbicide #2 at 100 pounds per acre or TCA at 50 pounds per acre, but by the same token it was also more toxic to the crop plants than were the TCA and Experimental Herbicide #2. Sweet clover and soybeans planted in June following the treatments were killed by all dosages of all chemicals. Corn was somewhat more resistant, with at least a few plants growing in each plot. Without exception Atlas sorghum was the most resistant to residual

toxicity of all the crops used in these tests. Its growth was near normal in plots treated with 100 pounds per acre of Experimental Herbicide #2 or 100 pounds per acre of TCA. (Contribution of the Kansas Agricultural Experiment Station, Manhattan, Kansas.)

Pre-emergence treatment of established stands of Johnson grass. McCall, G. L. and J. W. Zahnley. A series of plots were laid out to test the effect of pre-emergence treatments on the rhizomes of Johnson grass infesting creek bottom land of a light sandy loam texture. Applications were made to the soil on April 20, 1950, approximately 1 to 2 weeks before the emergence of plants that sprouted from the rhizomes. 2,4-D was applied as the dimethylamine salt to the soil at a rate of 40 pounds per acre, while trichloroacetic acid was applied as the sodium and calcium salts at rates of 40 and 80 pounds per acre. The 2,4-D treatment was a complete failure so far as control of Johnson grass rhizomes was concerned. It did control the Johnson grass seedlings and prevent their establishment. At the end of the growing season, the areas treated with 2,4-D were as heavily infested with Johnson grass as the untreated areas. The TCA pre-emergence treatments were outstanding, giving 95-100 percent control of Johnson grass rhizomes and complete control of the seedlings. However, these treatments at 40 pounds per acre eliminated all test plants sown two months later (corn, Atlas sorghum, soybeans, peas, flax, oats, barley and sweet clover) with the exception of corn and Atlas sorghum. These two crops had good vigor and a 90 percent stand. At 80 pounds per acre of TCA, corn was nearly completely eliminated, but the sorghum made almost normal growth. (Contribution of the Kansas Agricultural Experiment Station, Manhattan, Kansas.)

TCA and IPC to control and eradicate Johnson grass. McKibben, G. E. and R. F. Fuelleman. Square rod plots of Johnson grass were treated with 80 and 160 pounds of sodium TCA per acre. Similarly, IPC was applied at 80 and 160 pounds per acre. The applications were made on June 25, 1949. The grass was 5-6 feet tall. No regrowth of Johnson grass has reappeared on the TCA-treated plots since the time of application as observed on October 3, 1950. IPC caused some reduction in the stand of Johnson grass but did not prevent new growth from the rhizomes from reappearing quickly. A second series of plots located in a pasture at the Dixon Springs Station have been under observation for several years. The area of Johnson grass has not spread, and the plants are not thrifty because the grass is kept in a closely cropped condition by cattle and sheep. (Contribution of the Illinois Agricultural Experiment Station, Urbana, Illinois.)

Progress report of field control of Johnson grass in Indiana. Oyer, E. B., Lee, O. C., and Gries, G. A. Five different herbicides and a variety of cultural practices were tested in two different locations in southern Indiana for their effectiveness in the control of Johnson grass. Chemical treatments included various rates of 2,4-D, 2,4,5-T, TCA, sodium chlorate, maleic hydrazide and maleic hydrazide followed by TCA. Cultural practices included clipping and cultivation. Combinations of cultural practices and chemical treatments were also used. Sodium chlorate applied at 480 lb./A. resulted in complete kill of both tops and rhizomes. Severe top injury was caused by early summer applications of maleic hydrazide at 30 lb./A. and TCA at 100 lb./A. TCA at the 60 lb./A. rate was quite effective when applied later in the growing season. No significant differences were observed whether TCA was applied to the foliage or stubble. Some stand reduction was obtained with 2,4-D at 15 lb./A. and with 2,4,5-T at 10 lb./A., but neither gave satisfactory field control. Observations indicate a definite reduction in development of rhizomes with all rates of TCA at one location. Final determinations of the effect of the various treatments on the rhizomes will be made next spring. Samples of rhizomes were collected at 2-week intervals from selected plots for a study of the effect of various treatments

on the accumulation of food reserves. A program is in progress to determine the effectiveness of different materials and different dates of application for winter sprays in the control of Johnson grass. (Contribution of Agricultural Experiment Station, Purdue University, La Fayette, Indiana.)

TCA on Johnson grass: rates, dates, cultural treatments. Peters, Robert A. and C. J. Willard. Experiments near Waverly, Ohio, on sandy loam river bottom soil, in corn last year, nearly solid stand of Johnson grass. Plots 14 x 30 feet. Three replications, split plot design. Treated May 15 (old plants 6 inches high, seedlings 2 inches); June 15 (old plants 24 inches high, seedlings 12 inches); July 15 (full bloom, 6-8 feet, mowed and removed before treatment); August 15 (seed shattering, also mowed and removed). Five rates each date, 0, 25, 50, 100, and 200 lb./A. of 90 percent TCA were applied to each of 6 cultural treatments on each date. Plowing at once after treatment was unfavorable. Plowing before treatment appeared generally advantageous, especially in the control of seedlings. No evidence of translocation or other advantage for top growth at time of treatment, and treatment on bare ground is more easily done. In the May treatment, rhizomes almost 100 percent killed by 100 and 200 lb./A., agronomically satisfactorily killed by 50 lb.; 25 lb. not satisfactory. The May treatment induced dormancy, followed by gradual death, of the rhizomes, which were black and dead by September. June treatment was similar; rhizomes were not yet dead in September. Later treatments must wait until next year for evaluation. Better kills of tops at later dates. Reinfestation from seed followed all rates of treatment 9 weeks after May and June treatments, 12 weeks after July treatment. Since TCA will prevent obtaining a crop after any spring treatment, it seems far wiser to start applications in the late summer or fall. Then both rhizomes and seedlings will be disposed of in one treatment, and TCA will be out of the soil by the next year. Of course the Johnson should be mowed several times before fall or summer treatments. If the infestation is where it cannot be mowed, start early, and re-treat in July or August for seedlings. A small preliminary test applied March 29 (Johnson dormant) resulted in a complete kill from 100, 200, and 250 lb./A., and fair kill from 50 lb./A. Seedlings took over in July, but ground was bare to late June. (Contribution of the Ohio Agricultural Experiment Station, Columbus, Ohio.)

Johnson grass: chemical and cultural control. Willard, C. J., D. F. Beard, Harry Vallery, and R. Q. McFerren. This demonstration-experiment was planned by Beard and Willard and carried out by Vallery and McFerren, on the former's farm near Waverly, Ohio. A strip in an area of alfalfa-Johnson meadow, cut regularly in 1949, was plowed late in August, 1949. Half the strip was cultivated 3 times before frost, and 7 chemical treatments were laid out across the other half and a similar unplowed strip. The treatments were: Applied September 6, 1949: (1) 320 lb./A. of sodium chlorate; (2) 80 lb./A. sodium chlorate; (3) 23 lb./A. of 90% STCA; (4) 45 lb./A. STCA; (5) 90 lb./A. STCA. Applied May 1: (6) 30 lb./A. STCA; (7) 60 lb./A. STCA. The entire field was planted to corn about June 18. There was still much Johnson grass in the main field, though it was commercially controlled by cultivation; plots 1, 2, 4, 5 and 7, and the strip cultivated 3 times last fall, were practically free. There was some in plots 3 and 6. Corn was largely killed in plots 6 and 7--no residual effects from any fall treatment. The late preparation of this field for corn is worth emphasizing as a practical help in growing corn in Johnson grass infested fields--several farmers in the area have adopted late preparation and planting as a regular plan. (Contribution of the Ohio Agricultural Experiment Station, Columbus, Ohio.)

Project I. Control of Perennial Herbaceous Weeds.

Leafy Spurge — Thomas K. Pavlychenko

Summary

Systemic herbicides of 2,4-D, 2,4,5-T and MCP groups were applied at various rates and stages of growth to destroy this weed. In general, the results were as follows:

(1) The top growth was easily killed by the majority of ester and amine formulations, if treated at reasonably succulent stage.

(2) Regrowth was recorded in every experiment where one or two treatments were made, irrespective of the chemicals and the rates used.

(3) Where low rates (¾ to 1 lb./a.) were used repeatedly over a period of two seasons, complete eradication of the original stand was obtained with five or more treatments.

(4) On land thus eradicated, a reinfestation usually took place from seedlings.

(5) A sod of grass always was helpful in eradicating this weed with 2,4-D formulations, particularly esters.

(6) Pre-emergence or early rosette treatments were less effective than applications made in the bud or bloom stages.

Contact chemicals, Borascu, Polybor or Chlorates and Amate were used. Two treatments with Sodium Chlorate at 1000 to 1680 lbs./a. each gave 100 pct. kill but the soil remained sterile for five seasons.

Borascu and the related compounds applied at 5 to 20 lbs./sq. rod, or 800 to 3200 lbs./a., gave 90 to 99 pct. kill.

Ammonium sulphamate (amate) at high rates and various 2,4-D formulations used alone caused certain damage to leafy spurge. When the two chemicals were used together, the effectiveness of both was increased by approximately 10 pct.

GENERAL report on experimental work with leafy spurge since 1938. Brown, D.A. Work at this farm for the eradication of leafy spurge began in 1938. At that time cultivation was compared with Atlacide and sodium chlorate. Two successive years of summerfallow made a 90 pct. job of eradication but re-infestation by way of seedlings took place, Atlacide and sodium chlorate, when applied at 1000 to 1680 lbs. per acre in September and again the following June, gave a complete kill but the soil was left sterile for nearly 5 years. Experiments with 2,4-D were continued for 4 years. Rates from 8 oz. to 3 lbs./a. of sodium, amine and ester formulations of several companies were included in the test. Treatments were made from early June till mid-October with plants in (a) pre-bud, (b) early bud, (c) full bloom, (d) post bloom, (e) fall rosette stages. The early bud stage appeared to be the most vulnerable to the single treatment. Repeated treatments were also made. The plots receiving five treatments during a season showed good kills with all formulations at as low as 1 lb. acid per acre. In fact in two years of work it was fairly well established that a 90 to 100 pct. kill of roots could be obtained by 5 repeated dosages of at least 1 lb. of 2,4-D acid per acre. Plots where complete eradication was obtained grew up the following year in couch grass and sweet clover. These plots when spraying started had a full and pure stand of leafy spurge with the exception of weak plants of couch grass. On another experiment, heavily infested land was seeded to crested wheat grass. For 4 years hay was taken on this field and heavy pasturing done in the Fall. The stand of spurge was reduced by 40 pct. but at the time the grass was broken up the spurge was by no means eradicated. The heavy stand of grass merely kept the weed subdued for several years. (Contributed by Dominion Experimental Farm, Brandon, Man.).

A STUDY on the evaluation of herbicides for the control of leafy spurge. (Euphorbia esula). Heggeness, H.G. and Miller, J.H.. Twenty-one promising herbicides were sprayed on individual plots of leafy spurge, each of which was delimited by a furrow about 6 inches deep and 10 inches wide. A mixture of borax and polyborchlorate was placed in the furrow at a rate of 30 lbs. per square rod to prevent roots from spreading into neighboring plots. Herbicides selected for the study included maleic hydrazide, disodium 3, 6 endoxyhexahydrophthalate, nine 2,4-D formulations, five 2,4,5-T formulations, two mixtures of 2,4-D and 2,4,5-T and three MCP formulations. Based on Fall observations, the following were considered promising for the control of leafy spurge: emulsified acid of 2,4-D, polypropylene glycol butyl ester of 2,4-D, Dimethylamine salt of 2,4-D, isopropyl ester of 2,4-D and 2,4-D acetanilide. The other chemicals were of questionable value or of little value for the control of leafy spurge. Since the extent of root kill could not be readily determined, it is essential to delay evaluation until after spring observations can be made. It was also observed that the herbicides varied in the time required for them to injure the leafy spurge, but this was not necessarily correlated with herbicidal properties. All herbicides injured the top growth of leafy spurge, but varied in their ability to reduce the vigor of the plants. (Contribution of Minnesota Agricultural Experiment Station and U.S.D.A. Bureau of Plant Industry.).

SEVERAL new herbicides on leafy spurge (Euphorbia esula) at pre-emergence state of growth. Kratochvil, D.E., Hay, James, Derscheid, L.A., and Stahler, L.M. Duplicate 16 x 16' plots of leafy spurge were treated at pre-emergence stage of growth with 1, 2, 4, 6 and 8 lbs. acid per acre of the amine of 2,4-D, and 1, 2 and 4 lbs. of ethyl ester of 2,4-D butoxy ethanol ester of 2,4-D, Dow H1010, ACP 648, 2 methyl 4 Chloro phenoxyacetate, amine of 2,4,5-T, Dow 2,4,5-T, pentasyl ester of 2,4,5-T, pentasyl ester of 2,4-D and the acetanilide of 2,4-D. The spurge was summerfallowed in 1949 and planted to rye in the Fall of 1949. Treatments were made in the rye. Check plots showed an average count of 45.5 plants per sq.

yd., August 17th 1950. Treated plots were compared to this average. No chemical at any rate showed a reasonable degree of control. Counts indicated no marked advantages for any one of the several formulations used. No advantage was shown for any rate of any one of the herbicides used. Results, while only preliminary, of these herbicides, indicate little advantage in spring pre-emergence applications of these herbicides on leafy spurge. (Contributed by Agronomy Department of South Dakota Agricultural Experiment Station and Bureau of Plant Industry, U.S.D.A.).

EFFECT of treating leafy spurge (Euphorbia esula) with various boron compounds at several rates of application in Kingsbury County, South Dakota, 1949. Kratochvil, D.E., Derscheid, L.A., Hay, James, and Stahler, L.M. Randomized 10 x 10' plots of leafy spurge were treated in duplicate with 16.34, 21.78 or 27.23 lbs. per square rod of Borascu; 8.17, 10.89, 13.61 or 16.34 lbs. of Concentrated Borascu; 8.17, 10.89, 13.61 or 16.34 lbs. of Polybor; 5.45, 8.17, 10.89 or 13.61 lbs. of Polybor-chlorate. Treatment was made June 2, 1949 when the leafy spurge was starting to bloom. Counts were made August 26, 1949 and June 20, 1950. All formulations and rates showed a higher percent kill in 1950 than in 1949. Borascu eliminated 100 pct. of the spurge at 27.23 lbs. per sq. rod. All rates of Borascu eliminated 97 pct. or more. 10 lbs. of concentrated Borascu and above eliminated 95 pct. or more. 13.61 lbs. of Polybor, 10.39 lbs. of Polybor-chlorate eliminated 95 pct. or more. Seedlings were present on all plots. Brome grass in the plots was either injured or killed by all chemicals and rates except Polybor at 8.17 lbs. This rate of Polybor showed no apparent injury to brome grass and the percent elimination of leafy spurge was 87.1. (Contributed by the Agronomy Departmentof the South Dakota Experiment Station and the Bureau of Plant Industry, Soils and Agricultural Engineering, U.S.D.A.

EFFECT of systemic herbicides on leafy spurge (Euphorbia esula), 1950. Pavlychenko, Thomas K. Replicated, 16x50' plots, fairly evenly infested with leafy spurge, on light sandy soil in Saskatchewan, were treated on June 27th in bloom with KCN (Potassium cyanate) at 8 and 16 lbs./a. and at 2 and 4 lbs./a. of ACP 472 (2,4-D acid); ACP 644 (Isopropyl-phenyl-carbamate); ACP 648 (ester of 2,4-D); ACP 638 (acid of 2,4-D) and ACP 649 (ester of 2,4-D). Although 100 pct. top kill was obtained with the majority of the chemicals used, regrowth was general. On July 19th, the plots were subdivided, each into three equal parts. One of these was not resprayed. One was resprayed with 4 lbs./a. acid equivalent of Weedone LV 4 in water and one with the same strength of this formulation in oil. RESULTS: On Sept. 15th, records were taken in the three series of treatments. In the series of single spraying, the best results were obtained with ACP 472, 4 lbs./a. (99 pct. top kill and 20 pct. regrowth) followed by ACP 649, 4 lbs./a., (100 pct. top kill and 40 pct. regrowth) and the mixture of ACP 638 and 648 in equal parts (100 pct. top kill and 55 pct. regrowth). The regrowth in other plots was 60 or more pct. of the original stand. Re-treated with LV 4 in water gave 100 pct. top kill in all cases. Regrowth was absent only in the KCN plots. ACP 472, 4 lbs./a., gave only 2 pct. regrowth in terms of the original stand; it was followed by ACP 649, 4 lbs./a., with 18 pct. and a mixture of ACP 638 and 648 with 24 pct. regrowth. The other chemicals gave from 63 to 109 pct. regrowth. The treatment in oil seemed to be more effective. Unfortunately, the population before the respraying was quite low over this area and it was decided not to draw any further conclusions at this time. (Contributed by Agr. Div., American Chemical Paint Company, Saskatoon, Sask.).

EFFECT of systemic herbicides on leafy spurge (Euphorbia esula), 1950. Pavlychenko, Thomas K. Replicated, 16x50' plots, fairly evenly infested with leafy spurge, on light sandy soil in Saskatchewan, were treated on June 27th in

bloom with 2 and 4 lbs./a. acid equivalent of LV 4 (butoxy ethanol ester of 2,4-D); ACP 646A (2,4-D acetanilide); Dow Brush Killer (butyl ester of 2,4-D and 2,4,5-T); ACP 903 and 912 (ester formulations); ACP 926 (acid 2,4-D and 2,4,5-T) and Weedone Brush Killer 32 (butoxy ethanol ester of 2,4-D and 2,4,5-T). On July 19th, the original 16x50' plots were subdivided into three equal parts. One of these in each plot was not resprayed; one was resprayed with 4 lbs./a. of Weedone LV 4 in water and one with the same amount of this formulation in oil. In the Fall, the results were: in single treatment, 100 pct. top kill in all plots excepting ACP 912, 2 lbs./a., where the kill was 50 pct.; in the resprayed plots (water and oil) 100 pct. top kill in all cases. Regrowth was quite general in all three series, with the single spraying being the highest, followed by the water-borne and oil-borne retreatments. (Contributed by Agr. Div., American Chemical Paint Company, Saskatoon, Sask.).

CONTROL of leafy spurge (Euphorbia esula) with 2,4-D and 2,4,5-T. Slife, F.W. and Fuelleman, R.F. Replicated square rod plots of leafy spurge were treated with 2,4-D ester, 2,4-D amine and 2,4,5-T ester at ½, 2 and 4 lbs. acid per acre. Plots were treated in May and July in 1948, 1949 and in 1950. Each plot has been treated 6 times during this 3-year period. None of these treatments have been effective in complete eradication of the leafy spurge. Prior to the 1948 treatment, the leafy spurge in this area had had no previous control and the land had been abandoned to this weed. Plots located in areas with good cultural practices previous to treatment have indicated that this weed can be eradicated under these conditions. (Contribution of the Illinois Agricultural Experiment Station, Urbana, Illinois)

EFFECT of several boron formulations as herbicides for control of leafy spurge (Euphorbia esula), Brookings, South Dakota, 1949. Stahler, L.M. Kratochvil, D.E., Hay, James and Derscheid, L.A. Borascu at 15 lbs. per square rod; Concentrated Borascu at 10, 15 & 20 lbs.; Polybor at 10 and 15 lbs.; Polybor-chlorate at 5 and 10 lbs. per square rod were applied to replicated 16x16' plots of leafy spurge in early bloom stage on May 25, 1949. All materials were applied dry with the exception of Polybor-chlorate, which was in a spray solution. Plots treated with 15 lbs. Borascu, which consistently eliminates 95 to 100 pct. of spurge plants, showed 10 pct. survival October 1, 1949 and 9 pct., Sept. 30, 1950; Concentrated Borascu at 10, 15 and 20 lbs. showed 5, 10 and 10 pct. survival, respectively, October 1, 1949 and 9, 2 and 1 pct. Sept. 30, 1950; Polybor-chlorate at 5 and 10 lbs. showed 60 and 20 pct. survival, respectively, October 1, 1949 and 10 and 1 pct., Sept. 30, 1950; Polybor at 10 and 15 lbs. showed 40 and 5 pct. survival, respectively, October 1, 1949 and 8 and 5 pct. survival, Sept. 30, 1950. Herbicides were furnished by Pacific Coast Borax Co. (Contributed by Bureau of Plant Industry of U.S.D.A. and Agronomy Department of South Dakota Agricultural Experiment Station).

RESPONSE of leafy spurge (Euphorbia esula) to two years application of combinations of 2,4-D and ammonium sulfamate. Warden, Robert L. Combinations of 2,4-D and ammonium sulfamate (amate) applied to a dense stand of leafy spurge in a foothill grassland area in 1948 and repeated under dry growing conditions on July 13, 1949. Each year's application consisted of duplicate plots of all possible combinations of 1, 2 and 3 lbs. acid equivalent of sodium 2,4-D acetate and 33, 67 and 100 lbs./a. amate, as well as 2 and 3 lbs. 2,4-D alone. Only the results of 1949 treatments and comparisons with 1948 treatments are included here, since 1948 results were presented in the 1949 NCWCC Research Report. The repeat application of the combinations increased average kills of established plants from 67 to 89 pct. Kill of established plants by 2,4-D alone was 32 pct. for the 2 lb. rate and 24 pct. at 3 lbs. Percent control obtained by the use of 33 lbs. amate

and 1, 2 and 3 lbs. 2,4-D was 80, 77 and 78 respectively. With 66 lbs. amate and 1, 2 and 3 lbs. 2,4-D, control was 90, 93 and 91 pct. respectively. 100 lbs./a. amate and 1, 2 and 3 lbs./a. of 2,4-D increased kills to 96, 92 and 99 pct. The higher amate rates seem to be the major factor in increasing kills. Very little difference is evident between rates of 2,4-D in this test. Previous work has indicated, however, that some 2,4-D is required and that the combination is more effective than either herbicide alone. On some plots, almost complete kill of the original plants was obtained, yet dense stands of spurge seedlings were evident. Grass density has been increased in all plots receiving herbicidal applications. The test area was retreated in 1950 with 4 lbs. amine 2,4-D per acre. (Contribution of the Agronomy and Soils Dept., Montana Agricultural Experiment Station.).

RESPONSE of leafy spurge (Euphorbia esula) to combinations of high rates of 2,4-D and low rates of ammonium sulfamate. Warden, Robert L. All possible combinations of 0, 3, 4 and 5 lbs. acid equivalent of sodium 2,4-D acetate and 0, 10, 20, 30 and 40 lbs./a. ammonium sulfamate (amate) were applied on grass land and on fallow to a dense stand of leafy spurge on late bloom under dry conditions on July 14, 1949. Three replications were used on grassland and three on fallow. Readings on leafy spurge taken June 21, 1950 indicated the following results: (1) Stand reductions on all grassland plots averaged 45 pct. as compared to 35 pct. on fallow. (2) Kills in plots used in combination with the 4 rates of 2,4-D were as follows: 15, 33, 42, 52 and 58 pct. at 0, 10, 20, 30 and 40 lbs./a. rates of amate respectively. (3) Rates of 2,4-D at the 5 amate rates resulted in kills as follows: 19, 42, 43 and 56 pct. at the 0, 3, 4 and 5 lbs./a. rates of 2,4-D respectively. (4) The 3, 4 and 5 lb. rates of 2,4-D without amate gave 14, 18 and 30 pct. stand reductions respectively, and the 10, 20, 30 and 40 lb. rates of amate alone reduced stands 6, 18, 25 and 42 pct. respectively. (5) Some activation seems to occur when these herbicides are used in combination. This activation was measured by totalling the control obtained for each rate of the herbicides applied alone and checking that figure against the control obtained by the particular combination. For example, the 5 lb. 2,4-D rate alone gave 30 pct. control and the 10 lb. amate rate gave 6 pct. control, total of 36 pct. control. Since the control obtained for this treatment was actually 46 pct., the additional 10 pct. can be attributed to increased herbicidal activity. The average control of the 12 treatments receiving both 2,4-D and amate was 10 pct. higher than could be expected by both materials acting singly. (Contribution of the Agronomy and Soils Dept., Montana Experiment Station.)

CONTROLLING leafy spurge with 2,4-D. Wood, H.E., Craig, H.A., Breakey, W.J. For the fourth consecutive season spraying operations have been carried out on a field of light soil under pasture, which carried a heavy infestation of leafy spurge in competition with native grasses and quack grass. In 1950, the entire field was sprayed with an ester of 2,4-D at approximately 1 lb. acid per acre, in the full to late flower stage (June 22), whereas in previous years varying rates, to as high as 8 lbs. acid per acre, with some plots re-treated in early fall, had been tried. In addition, a large acreage in another part of Manitoba, also on light soil and in competition with similar grasses but not pastured, has been sprayed with an ester of 2,4-D at approximately three-quarters of a pound acid per acre in the full flower stage, for the past two seasons. Results obtained are in keeping with those reported in 1949, as follows: 1. Spraying once during the season at full to late flowering, using an ester of 2,4-D at three-quarters pounds per acre, prevents seeding in the year of treatment; 2. Treatment carried over a number of seasons results in a marked reduction in stand of spurge, with a corresponding increase in stand of grass; 3. In no instance has complete eradication of this weed been obtained. (Contribution of the Weeds Commission, Manitoba Dept. of Agriculture, Winnipeg, Canada, in co-operation with the Dominion Experimental Station, Morden, Manitoba).

Project I. Control of Perennial Herbaceous Weeds.

Field Bindweed — Investigation leader: V. W. Woestemeyer

Summary

Sixteen abstracts of reports on bindweed control were submitted from four sources. The reports show good control with 2,4-D whenever applications were made with favorable growing conditions but eradication requires repeated treatments. One abstract reports eradication in 3 seasons, one treatment each year. Generally one formulation is considered as effective as another under favorable growing conditions, but the esters may have some advantage when conditions are below optimum. Results of spraying with 2,4-D with unfavorable growing conditions have not been satisfactory. One pound acid equivalent per acre is a satisfactory rate under optimum conditions. 2,4-D is equal to or better than 2,4,5-T or mixtures of the two. The use of 2,4-D in combination with grass or close drilled crops has given more rapid reductions in bindweed stands than 2,4-D alone but not necessarily quicker eradication. Spraying should be done out of crops when possible to avoid the risk of crop damage and reduced yields. Reduced rates are avisable where necessary to spray in crops.

Of the borax and sodium chlorate materials the following rates per square rod were comparable in effect and generally satisfactory; borascu, 30 pounds; concentrated borascu, 14 to 16 pounds; polybor, 10 to 12 pounds; polybor-chlorate, 8 to 10 pounds; sodium chlorate, 5 pounds. Applications made on different dates during a dry period showed little effect until after sufficient rainfall.

One abstract indicates excellent control and in one case eradication of bindweed by making fall seedings of alfalfa or some grasses or mixtures after a season of intensive cultivation. Another reported successful seedling control for six years with continuous wheat cultivated with a duckfoot once a month between harvest and seeding or with excellent alfalfa stands. Seed counts in the soil were reduced most on plots cultivated the most through the growing season. Bindweed stands have been reduced over 90 percent with 14 duckfoot cultivations in one season.

Abstracts of Results of Cooperators

The use of perennial forage crops for the control of field bindweed at Scotland, South Dakota. Derscheid, Lyle A., D. E. Kratochvil, James Hay, and L. M. Stahler. Duplicate 1/10 acre plots of alfalfa, Ree wheatgrass, brome grass, Crested wheatgrass, alfalfa-brome, alfalfa-crested, and alfalfa-Ree were started in 1946, 1947, and 1948. The crops were seeded in the fall after the land had been cultivated with a duck-foot cultivator at two week intervals from May 1. Bindweed counts were made in the spring of each year. Percent elimination was determined by comparing the 1950 counts to those made before the original cultivation. By 1950 the alfalfa seeded in 1946 had eliminated 100 percent of the bindweed; Ree wheatgrass - 42 percent; brome - 75 percent; crested wheatgrass 37 percent; alfalfa-brome mixture 95; and alfalfa-crested 98 percent. The alfalfa-Ree mixture was not used until 1947. Counts were not made when the 1947 plots were started, however, the 1948-1949 and 1950 counts of these plots indicate that alfalfa, brome, alfalfa-brome, and alfalfa-crested were giving about the same

results as the plots started in 1946. With only two years of competition, plots started in 1948 have not given as high percent elimination as the plots started in 1946 and 1947. Alfalfa planted in 1948 has eliminated 77 percent of the bindweed, Ree wheatgrass 87 percent; brome 61 percent; crested wheatgrass 32 percent; alfalfa-brome 15 percent; alfalfa-crested 73 percent and alfalfa-Ree wheatgrass - 84. (Contributed by the Agronomy Department of the South Dakota Experiment Station and the Bureau of Plant Industry, Soils and Agricultural Engineering, U.S.D.A.)

The effect of three 2,4-D formulations on field bindweed when applied at three rates and three stages of growth at Scotland, South Dakota, in 1949. Derscheid, Lyle A., L. E. Kratochvil, James Hay and L. M. Stahler. Triplicate 1 rod by 4 rod plots of field bindweed were treated with 1/2, 3/4 and 1 pounds acid per acre of the ester, amine and sodium salt formulations of 2,4-D at the bud stage of growth, post harvest, and fall regrowth. Plot area was plowed in the spring and seeded to oats. Treatments were made with a field trailer sprayer. Percent eliminations were determined by comparing treated plots to untreated plots. The bud treatment was made June 22 after poor moisture conditions during the spring period. Very little control of bindweed was obtained by any rate of treatment. The ester at 3/4 pound gave the highest elimination - 32%. Postharvest treatments were made August 8, 1949, after a rather severe drought during the spring and summer. No control was recorded for any treatment at this date. Fall treatments were made September 21 after having received 10 inches of rain between August 12 and the date of treatments. All treatments at this date showed some elimination; however, none gave better than 38% control. The amine formulation showed 38% control at the 1/2 and 3/4 lb. rates. This study indicates that under adverse growing conditions little control of bindweed can be obtained with 2,4-D treatments. (Contributed by the Agronomy Department of the South Dakota Experiment Station and the Bureau of Plant Industry, Soils and Agricultural Engineering, U.S.D.A.)

The effect of intensive cultivation, cropping and 2,4-D on the control of field bindweed at Bushland, Texas. Hamilton, Roger D. and H. E. Rea. Stands of field bindweed were reduced 90 to 95 percent from one plot to another by the end of the first crop season as the result of 14 cultivations with 24 inch sweeps operated to a depth of 4 to 5 inches on areas clean fallowed since the 1949 wheat harvest. On another series of replicated plots in this experiment, three applications of one pound of 2,4-D acid per acre of the isopropyl ester formulation applied during August and October of 1949 and June, 1950, respectively, reduced the stand of bindweed 32 percent and the 1949 applications delayed the 1950 spring emergence of this weed six weeks. Ten other treatments, including various combinations of intensive cultivation, cropping and 2,4-D are under study in this replicated test. (Contribution of the Amarillo Conservation Experiment Station, Amarillo, Texas.)

The effect of rate of application of 2,4-D and other chemicals on the control of field bindweed at Bushland, Texas. Hamilton, Roger D. and H. E. Rea. Square-rod plots of field bindweed in full bloom following excellent vegetative growth were treated June 6, 1950, at the rate of 1/4, 1/2, 1 and 2 pounds of acid per acre with the following chemicals and mixtures: sodium salt, ethanol amine, isopropyl ester and amine emulsion of 2,4-D; 2,4,5-T ester; 2,4-D and 2,4,5-T mixture; Dow A-910 and Dow H-1010. One quart of the carrier per plot was used in applying these chemicals with a knapsack sprayer. Ammate and T.C.A. at the rates of 1/2,

1 and 2 pounds per square rod were also applied on that date. Preliminary results indicate that; 1/2 and 1 pounds per acre of the various 2,4-D formulations are as effective as 2 pounds, the ester and amine of 2,4-D are equally effective in controlling bindweed under conditions in Northwest Texas, 2,4-D alone is as effective or more so than 2,4,5-T alone or as a mixture with 2,4-D or Dow A-910, Dow H-1010 and isopropyl ester of 2,4-D are about equally effective, and all rates of Ammate and T.C.A. used killed the tops of bindweed followed by stunted and discolored regrowth. (Contribution of the Amarillo Conservation Experiment Station, Amarillo, Texas.)

The effects of soil sterilants in eradicating field bindweed on cultivated land at Dumas, Texas. Hamilton, Roger D. and H. E. Rea. Field bindweed was treated with 3, 5 and 7 pounds of sodium chlorate and 24, 30 and 34 pounds of Borascu per square rod, respectively, during August, September, October and November, 1949. Also during November, 1949, 3, 5 and 7 pounds of Atlacide per square rod; 14, 16 and 18 pounds of Concentrated Borascu; 8, 10 and 12 pounds of Polybor and 8 and 10 pounds of Polybor Chlorate, respectively, were applied to this weed. All chemicals were applied dry to duplicate plots with a Gandy spreader. Rainfall from August, 1949, to October, 1950, was 23.5 inches, of which only 3.5 inches in light, ineffective showers fell during the first 8 months. By the spring of 1950, the chemicals were still within the upper 2 to 4 inches of the soil in most cases. The time of applying sodium chlorate and Borascu had made no differences in their effect on bindweed for the rates used by the end of the first season after application. The lowest rates of sodium chlorate, Borascu and Concentrated Borascu reduced the stand of bindweed from 60 to 80 percent from one treatment to another. The range of reduction for the intermediate rates of these chemicals was 85 to 98 percent and was about the same as for the highest rates used. The effects of the Borascu and Concentrated Borascu were still evident in October, 1950. Sodium chlorate was slightly more effective in eradicating bindweed than corresponding rates of Atlacide and 12 pounds of Polybor was as effective as 14 pounds of Concentrated Borascu. Eight and 10 pounds of Polybor Chlorate reduced the stand of bindweed to within the range of 90 to 95 percent. (Contribution of the Amarillo Conservation Experiment Station, Amarillo, Texas.)

The effects of soil sterilants in eradicating field bindweed on cultivated land at Claude, Texas. Hamilton, Roger D. and H. E. Rea. Field bindweed was treated with 3, 5 and 7 pounds of sodium chlorate and 24, 30 and 34 pounds of Borascu per square rod, respectively, during August, September, October and November, 1949. All chemicals were applied dry to duplicate plots with a Gandy spreader. Rainfall from August, 1949, to October, 1950, was 25 inches, of which only 5 inches in light, ineffective showers fell during the first 9 months. By the spring of 1950, the chemicals were still within the upper 2 to 4 inches of the soil in most cases. The time of applying sodium chlorate and Borascu had made no differences in their effect on bindweed for the rates used by the end of the first season after application. The lowest rates of sodium chlorate and Borascu reduced the stand of bindweed from 40 to 85 percent from one treatment to another. The range of reduction for the two higher rates of these chemicals was 60 to 90 percent for sodium chlorate and 85 to 95 percent for Borascu. The plants surviving the sodium chlorate treatment had lost most of their chlorotic appearance by October, 1950, but the effects of the Borascu was still evident at that time. (Contribution of the Amarillo Conservation Experiment Station, Amarillo, Texas.)

Field bindweed control with 2,4-D combined with competitive crops and intensive cultivation. Phillips, W. M. Experiments in progress for 5 years have shown that 2,4-D is more effective in controlling bindweed when combined with competitive crops than when used alone. Small grain, sorghum and Buffalo grass have been used as competitive crops. Drilled sorgo following either fall or spring applications of 2,4-D has proved effective in controlling the weed. Spring oats or barley are also excellent competitors. Fall sown wheat provides the desired competition, but it is often difficult to find a desirable time to apply the chemical. Fall applications of 2,4-D on wheat have resulted in reduced yields. Spring applications in wheat have reduced the stand of bindweed, but it is difficult to get adequate coverage of the bindweed and there is some danger of damaging the wheat. Also, when the spraying is done in a growing crop 1/2 pound 2,4-D per acre is used, while one pound is applied when there is no crop on the land. The 2,4-D treatment followed by sorghum planted in 40-inch rows is not so effective as when followed with a close-drilled crop. Intensive cultivation of the bindweed when the land is not being cropped has reduced the time necessary for eradication. The chief advantage of the combination of 2,4-D and cropping over competitive cropping alone appears to be in the time necessary to thin the stand of bindweed, rather than in the lenth of time required for eradication. Seeding Buffalo grass following treatment with 2,4-D and retreating in the grass has given highly successful results. (Contributed by Division of Weed Investigations, Bureau of Plant Industry, Soils, and Agricultural Engineering, U.S.D.A., Hays, Kansas)

Comparative effectiveness of six formulations of 2,4-D and 2,4,5-T in controlling field bindweed. Phillips, W. M. Alkanolamine, polypropylene glycol butyl ether ester, polyethylene glycol half ester, and the free acid of 2,4-D, and a pentasyl ester, and triethyl amine of 2,4,5-T were applied on triplicate plots of bindweed in full bloom at 1/2, 1, and 2 pounds per acre. In addition, the 2,4-D amine plus a sorbitan monolaurate wetting agent was applied at the same rates. Only preliminary results and observations are available at the present time. Seventeen days after spraying, none of the 1/2 pound rates had given complete top kill, and plant counts made in the fall indicate that this rate gave a smaller reduction in stand than the 1 and 2 pound rates. Four months after treatment average reduction in stand varied from 59 to 98 percent with no consistent trend with regard to the various chemicals tested. Observations will be continued in 1951. (Contributed by Division of Weed Investigations, Bureau of Plant Industry, Soils and Agricultural Engineering, U.S.D.A., Hays, Kansas)

The effect of 2,4-D on field bindweed. Phillipas, W. M. Several experiments started in consecutive years and following the outline of Project I have been carried out to test the effect of 2,4-D on field bindweed. Results indicate that, under conditions as they exist at Hays, Kansas, repeated applications of 2,4-D give good bindweed control but seldom result in complete eradication of the established stand. Time of application does not seem important provided the bindweed is growing vigorously. Optimum growth conditions usually exist at about the time the bindweed is blooming in the spring. The year 1950 was an exception and treatment at the earlier stages of growth resulted in greater reductions in stand. When sufficient moisture is available to provide good growing conditions, fall applications have proved satisfactory. The three common formulations of 2,4-D (ester, amine and sodium salts) have been compared. Little difference has been noted among the effects of these chemicals, although the esters have some advantage when growth conditions are below optimum. Rates of application have been from 1/2 to 4 pounds 2,4-D per acre. In nearly all cases rates less than 1 pound have not given so

great a reduction in stand as 1 pound or more. Rates above 1 pound have given little, if any improvement in results obtained. (Contributed by Division Weed Investigations, Bureau of Plant Industry, Soils, and Agricultural Engineering, U.S.D.A., Hays, Kansas)

Field bindweed control with boron type soil sterilants. Phillips, W. M. Borascu at 27, 33 and 41 pounds per square rod, concentrated borascu at 16, 22 and 27 pounds per square rod, polybor at 16 and 27 pounds per square rod and polybor-chlorate at 8, 16 and 24 pounds per square rod were applied to bindweed June 2, 1949. The same chemicals were applied at a lower rate October 17, 1949. Borascu at 30 pounds and concentrated borascu at 10, 12, 14, 16 pounds were applied April 6, 1950. By October 1950, none of the treatments had resulted in eradication, although nearly all had shown improvement since early summer. Little difference was noted among the various dates of application. This probably can be explained by the lack of sufficient rainfall until July 1950 to leach the chemical into the soil. The polybor-chlorate and the polybor gave complete top kill within a few days after application, and the polybor-chlorate plots remained free of weeds except for bindweed regrowth. The plots treated with the other chemicals became heavily infested with Russian thistle and Kochia. Results to date indicate that 16 pounds of concentrated borascu, 12 pounds of polybor and 10 pounds of polybor-chlorate are about equal to 30 pounds of borascu. These rates have given approximately 75 percent reduction in the number of bindweed plants. (Contributed by Division of Weed Investigations, Bureau of Plant Industry, Soils and Agricultural Engineering, U.S.D.A., Hays, Kansas)

The effect of borax materials on field bindweed. Woestemeyer, V. A. Borascu at 30 pounds and concentrated borascu at 10, 12, 14 and 16 pounds per square rod were applied to duplicate square rod plots in a uniform stand of field bindweed April 25, 1950. Soil remained dry into June and little effect was observed until mid-summer. Counts taken October 5 were as follows: concentrated borascu at 10, 12, 14 and 16 pounds, 69, 68, 32 and 3 plants per square rod; 30 pounds borascu, 50 plants per square rod; check, 300 plants per square rod. On June 20, 1950, unreplicated square rod plots were sprayed with polybor at 2, 4, 6, 8, 10 and 12 pounds per square rod, and Polybor-chlorate at 2, 3, 4, 6, 8 and 10 pounds per square rod. The materials were applied in solutions containing 1-1/2 pounds per gallon of water as foliage and soil applications. Plant counts on October 5 were as follows: For Polybor at 2, 4, 6, 8, 10 and 12 pounds, 60, 2, 70, 13, 1 and 1 plants per square rod and for Polybor-chlorate at 2, 3, 4, 6, 8 and 10 pounds, 200, 8, 53, 9, 1 and 0 plants per square rod. The check had 225 plants per square rod. (Contribution of Kansas Agricultural Experiment Station.)

Methods of controlling seedlings of bindweed by cultivation and cropping systems. Woestemeyer, V. A. Beginning in the fall of 1944 after all established plants of bindweed had been eradicated by cultivation, six duplicate treatments involving cultivation and cropping procedures were begun. They include continuous wheat, continuous listed atlas sorgo, a corn-oats-wheat rotation and continuous alfalfa. In addition to normal seedbed preparation, one wheat treatment calls for one duckfooting in September. All other treatments call for duckfooting once a month during the growing season when no crop is present. Continuous wheat duckfooted once a month between crops has given excellent control while one duckfooting between crops allows slow reinfestation. Alfalfa has been an excellent control crop so long as an excellent stand was maintained. Seedlings became established in

grassy spots. The rotation has allowed very slow reinfestation with five established plants per square rod in 1950. Continuous listed sorghum has not been satisfactory. Bindweed seed count was as high as 90 seeds per square foot to a depth of 8 inches when the cropping plan began. There has been very little reduction on alfalfa plots. On other plots the reduction varied with the amount of cultivation the plots received, with a reduction to 1/3 of the original count with the corn-oats-wheat rotation. (Contribution of Kansas Agricultural Experiment Station.)

Use of 2,4-D in controlling field bindweed. Uniform Project I, 1948. Woestemeyer, V. W. In 1948 duplicate square rod plots of field bindweed were sprayed with sodium salt, amine and ester formulations of 2,4-D at rates ranging from 1/2 to 3 pounds per acre. Applications were made at late bud (May 17), early bloom (June 9), and late fall (October 10) stages of growth. Retreatments were made in 1949 and 1950 according to the original plan. Plant counts were made each fall. The bloom stage application in 1948, fall application in 1949 and both spring applications in 1950 were made when conditions were dry and bindweed was not making rapid growth. Emergence after 1948 applications was 63 per cent after bud stage, 136 per cent after bloom and 52 per cent after fall treatments. Regrowth from 1949 treatments was 21, 21 and 29 per cent respectively after bud, bloom and fall applications, and regrowth from 1950 spring applications was 8 per cent for bud and 20 per cent for bloom stage. Reductions have been erratic but generally show no advantage for one formulation over another, and no advantage for rates heavier than 1 pound per acre. (Contribution of Kansas Agricultural Experiment Station.)

The effect of combinations of 2,4-D and intensive cultivation in eradicating field bindweed. Woestemeyer, V. W. Experiments were started in 1948, 1949 and 1950 to determine the effect of 2,4-D in comoination with intensive cultivation in eradicating field bindweed. Six duplicate treatments were started each spring, varying from spraying in the spring followed by cultivation as needed to complete eradication, to spraying in the spring after a season of intensive cultivation followed by cultivation as needed. Half of each plot is sprayed with 1-1/2 pound sodium salt per acre and half with 1-1/2 pound ester per acre. The 1948 treatments have been completed and the 1949 treatments are nearly complete. This limited data indicates that when the 2,4-D was applied some time during the first season, a total of 16 to 18 cultivations were required to complete eradication. This is about two cultivations less than when intensive cultivation alone was used, and the length of the procedure was about the same--slightly over two years. Where spraying in the spring follows a full season of cultivation, it is possible that the time and number of cultivations may both be reduced to a two year program. There has been no consistent advantage for one formulation of 2,4-D over the other. The 1950 experiment has not progressed far enough to indicate results. (Contribution of Kansas Agricultural Experiment Station.)

A comparison of the effectiveness of different commercial preparations of 2,4-D in eradicating field bindweed. Woestemeyer, V. W. Eight commercial preparations of 2,4-D including three salts, two amines, two esters and one acid were compared as sprays at the rate of 2 pounds 2,4-D per acre on duplicate square rod plots of field bindweed. Original applications were made May 27, 1946, on a uniform stand of bindweed averaging 477 plants per square rod. Bindweed was in the rapid growth-bud stage. Retreatments have been made at the same rate and stage of

growth each following year on plots still in progress. Plant counts were made approximately 90 days after each treatment. Counts in 1946 were from 36 to 66 plants per square rod remaining, with the esters and acid averaging slightly better kills than amines and salts. There was little change in the 1947 count but in 1948 further reductions were obtained on all plots. Each of three formulations had completed eradication on one of the duplicate plots. In 1949 seven additional plots were completed and in 1950 bindweed was present on only two of the original 16 plots. Since 1947 there has been no apparent advantage for any type of formulation. (Contribution of Kansas Agricultural Experiment Station.)

Controlling field bindweed with 2,4-D-cultivation-cropping combinations. Woestemeyer, V. W. Experiments have been started each year since 1947 to determine the use of combinations of 2,4-D and cultivation with wheat, oats and atlas sorgo for controlling field bindweed. Results indicate that several methods offer good control, but eradication has not yet been completed on any plots. Spraying before wheat seeding on a good growth of bindweed has given good control with no damage to the crop where seeding has been delayed for two weeks after a good rain following spraying. Spraying in spring offers little or no advantage and may result in damage to the crop. Spraying in fall prior to spring oats seeding has given only fair control. Spraying in the oats is less effective and has resulted in damage to the crop in some cases. Spraying in the fall and cultivating in spring before seeding drilled sorgo has been one of the most satisfactory methods, giving as high as 97 per cent reduction from one application. Spraying in spring before drilling has given good control, but bindweed has not always been fully emerged by the time spraying had to be done. Spraying at full emergence of bindweed in drilled sorgo has not reduced yields, but the sorgo provides a protective canopy over the bindweed and satisfactory coverage is seldom obtained. Spraying before listing sorgo has not been satisfactory, and has demonstrated the lack of full emergence at that time, while spraying at full emergence in listed sorgo has given good control with no reduction in yield. (Contribution of Kansas Agricultural Experiment Station.)

Project 1. Control of Perennial Herbaceous Weeds.

Hoary cress, Russian knapweed and all other perennial herbaceous weeds.

Robert T. Coupland

Summary

No abstracts were received concerning hoary cress and Russian knapweed, despite circulation of a request to all contributors to the 1949 Research Report. Answers to a questionnaire regarding classification of these weeds brought some response. One investigator in Saskatchewan reported that hoary cress is sensitive to 2 lb. of the ester formulation of 2,4-D. Reports from Manitoba are that the sodium salt, amine and ester forms of 2,4-D result in the eradication of hoary cress after five applications of ½ to 1 lb. of acid. Two applications of Atlacide of 500 to 1500 lb. per acre were reported to result in eradication of hoary cress in Manitoba. No difference was reported in response in different stages of growth. In Nebraska Russian knapweed is reported to be semi-tolerant to 2 to 4 lb. of 2,4-D ester, 2,4,5-T ester and amine, and to a mixture of 2,4-D and 2,4,5-T. Reports from Manitoba and Saskatchewan are that Russian knapweed is sensitive to ½ to 2 lb. of the ester formulation of 2,4-D, while in South Dakota it was tolerant of ½ to 1½ lb. of 2,4-D amine and ester.

Twenty abstracts were received reporting reaction of fourteen perennial herbaceous weeds to herbicides. These occur on the following pages.

Classification of fifty-one herbaceous perennials and common weedy shrubs occurs in tabular form following the abstracts. This is compiled from the reports of fourteen investigators who answered the questionnaire (300 circulated.) As in previous years, four classes were employed, as follows:

I.	(Very Sensitive)	Any perennial plant that is killed at indicated stages of growth with optimum application of an herbicide.
II.	(Sensitive)	Any perennial plant that is controlled by an optimum application of an herbicide at indicated stages of growth and is killed by repeated treatments.
III.	(Semi-tolerant)	Any perennial plant that is controlled by an optimum application of an herbicide at indicated stages of growth but is usually not killed by repeated applications.
IV.	(Tolerant)	Any perennial plant that is not controlled by applications of an herbicide at indicated stages of growth and is not killed by repeated treatments.

A feature of this year's list is the number of herbicides used in addition to 2,4-D and 2,4,5-T. These include T.C.A., sodium chlorate, Borascu, M.C.P., petroleum oil, Chlorosol A, L.P.C., Chlorax, polybor and polybor chlorate.

ABSTRACTS OF RESULTS OF COOPERATORS

Blueweed

The effect of various 2,4-D and 2,4,5-T formulations and carriers on the control of blueweed (Helianthus ciliaris) in a perennial grass mixture. Hamilton, Roger D. One and 2 pounds of acid per acre of 2,4-D ester, 2,4-D ester in oil, 2,4-D amine, 2,4-D amine emulsion, (1 gal. diesel fuel, remainder of carrier water), 2,4,5-T ester, and a 50-50 mixture of 2,4-D ester and 2,4,5-T ester were applied to patches of blueweed on July 3, 1950. The blueweed was in the bud to first-bloom stage of growth. The 2,4-D amine emulsion and the 2,4-D ester in oil were the only chemicals to give complete top kills. Some translocation was noted on the patches treated with the 2,4-D ester in oil. The 2 pounds of 2,4-D amine emulsion translocated 12 to 15 inches. No regrowth has occurred on these patches to date. Some discoloration was noted on the blue grama-buffalograss mixture. (Contribution of the Amarillo Conservation Experiment Station, Amarillo, Texas.)

The effects of various rates and chemicals on blueweed (Helianthus ciliaris), Hamilton, Roger D. Square rod plots of blueweed were treated with ¼, ½, 1 and 2 pounds of acid per acre of 2,4-D isopropyl ester, 2,4-D alkanalamine salt, 2,4-D sodium salt, 2,4-D amine emulsion (1 gal. oil, remainder of carrier water), 2,4,5-T ester, 50-50 mixture of 2,4-D ester and 2,4,5-T ester, Dow A-910, and Dow H-1010, on June 6, 1950. Also, treatments of ½, 1 and 2 pounds per square rod of sodium TCA and ammate were made at this date. The blueweed was in bud to first bloom stage of growth. Top kills were obtained with ammate and TCA; however, regrowth was made and seed was produced on these plots. All rates of the sodium salt, 2,4-D ester, 2,4-D amine, 2,4,5-T ester, 2,4-D and 2,4,5-T mixture were ineffective. The ¼ and ½ pound rates of amine emulsion were ineffective. The 1 and 2 pound rates of amine emulsion gave 70 to 99 percent top kill, respectively. A check on these plots showed root translocation of 12 to 18 inches. Percentage plant reduction cannot be determined since no regrowth has been noted on these plots to date. (Contribution of the Amarillo Conservation Experiment Station, Amarillo, Texas.)

Buttercup

The effect of selective herbicides on tall buttercup (Ranunculus acris) in pastures. Taylor, D. K. Square-rod plots of a pasture heavily infested with tall buttercup were sprayed with 2,4-D ester at 1, 2 and 4 pounds of acid per acre, M.C.P. at 1½, 2 and 4 pounds of acid per acre, and a mixture of 2,4,5-T and 2,4-D ester at 1 pound of acid of each per acre. The applications were made with a low volume boom sprayer at a time when the buttercup plants were approximately 24" in height. M.C.P. was the most promising of the three herbicides under trial giving an 85% kill at the 2 pound rate of application. The mixture of 2,4,5-T and 2,4-D ester also gave good results giving a 70% kill at the rate applied. Four pounds of acid per acre of the 2,4-D ester were required to produce results comparable to M.C.P. or 2,4,5-T with 2,4-D at 2 pounds of total acid equivalent per acre. (Contribution of the Dominion Experimental Farm, Agassiz, B.C.)

Cactus

Effects of 2,4-D on prickly-pear cactus (Opuntia polyacantha). Budd, Archibald C. and Mark R. Kilcher. Clumps of prickly-pear cactus were sprayed in July 1948, with both one-pound and two-pound per acre applications of 2,4,5-T and

also the same rates of an isopropyl ester. In August 1948 plots of the same species were sprayed with one-pound and three-pound rates per acre of T.C.A. (ammonium-trichloro-acetate). No killing effect of Opuntia was obtained from any of these applications. (Contribution from Dominion Experimental Station, Swift Current, Saskatchewan.)

Cockle

Control of white cockle by 2,4-D. Carder, A. C. In 1948 treatment consisted of ploughing, preparing a seed-bed and seeding in early summer without nurse-crop, in one instance to brome and in another to creeping red fescue. Good stands of grass were obtained along with a heavy emergence of seedling cockle (Lychnis alba). When the cockle was in the 3 to 5 leafed stage one-half of each area was treated with a butyl ester of 2,4-D at 16 ounces acid per acre. The remaining half of each grass plot was similarly treated when growth commenced the following spring. Results strongly favour the pre-winter application where, in the summer of 1949, it was noted that a 93 and 90 percent kill of cockle was obtained in the brome and fescue, respectively; while where treatment was deferred until the following spring only a 73 percent kill of the weed in brome and a 60 percent kill in fescue occurred. By the summer of 1950 the removal of cockle from the brome and fescue by the autumn application was 97 and 88 percent efficient, respectively; while by the spring application it was 75 and 65 percent complete in these grasses, respectively. The experiment points to the control of field-scale infestations of white cockle in the Peace River region as follows: partial summerfallow until midsummer, seed to brome without a nurse-crop, treat with 2,4-D ester at 16 ounces acid per acre in late summer or early autumn when the cockle is in the seedling stage, hand-pull surviving plants in subsequent years, renovate the brome stand when the situation warrants and follow by another 2,4-D application. (Contribution of Dominion Experimental Station, Beaverlodge, Alberta.)

Dogbane

The effect of 2,4-D in controlling dogbane. Woestemeyer, V. W. and Gene Heath. In 1948 dogbane was treated with 2,4-D in the early bloom stage June 14. Treatments were 1, 1½, 2 and 2½ pounds per acre in the ester form and 2 pounds per acre as sodium salt and amine. Top growth was dead on all ester plots in six weeks, while amine and sodium salt plots showed only slight yellowing of leaves. The area was plowed and drilled to wheat and no fall regrowth appeared. Plant counts per square rod on June 18, 1949, when retreatments were made at the original rates were: Check, 275; sodium salt, 275; amine, 175; ester 1, 1½, 2 and 2½ pounds, 25, 12, 16 and 16 plants, respectively. Top growth was dead four weeks after the retreatment on all ester plots, while amine and sodium salt treatments showed some yellowing of leaves. The area was again seeded to wheat. Plant counts taken June 19, 1950, were: Check, 175; sodium salt, 150; amine, 150; ester 1, 1½, 2 and 2½ pounds, 11, 7, 5 and 6, respectively. Retreatments made at that time again caused yellowing of leaves on sodium salt and amine plots and top kills on ester plots. The reduced counts on check and treated plots in 1950 are probably due in part to the unusually dry spring season. (Contribution of Kansas Agricultural Experiment Station and Marion County, Kansas, Noxious Weed Department.)

Garlic, wild

The response of wild garlic (Allium vineale) to 2,4,5-T, 3,6-endoxohexahydrophthalate, polypropylene glycol butyl ether ester of 2,4-D, and isopropyl ester of 2,4-D. Zalik, Saul, O. C. Lee, and G. A. Gries. The isopropyl ester of 2,4-D and 3,6-endoxohexahydrophthalate were applied to wild garlic on each of 5 dates between March 5 and May 20, at rates of 0.75, 1.5 and 3.0 pounds per acre of the corresponding acids. The heavy rate of 2,4-D caused some epinasty and accumulation of pigments at the base of the plants, but none of the rates gave any measurable kill nor did they prevent the production of aerial bulbils. No visible effects were produced by the 3,6-endoxohexahydrophthalate. In another location 2,4,5-T and the polypropylene glycol butyl ether and the isopropyl esters of 2,4-D were applied to wild garlic during a stage of rapid growth (May 20). The plants were beginning to show swellings on the aerial stalks where the bulbils develop. The herbicides were applied at 1.5 and 3.0 pounds per acre. The 2,4,5-T was applied in kerosene and the others as an aqueous spray. A month and a half after treatment control of top growth ranged from 30 to about 70 percent with 2,4,5-T giving slightly better control than the 2,4-D formulations. In October all the plots had a fairly heavy regrowth of garlic. (Contribution of the Department of Botany and Plant Pathology, Agricultural Experiment Station, Purdue University.)

Goldenrod and Water Hemlock

Effects of 2,4-D on herbaceous perennials. Kilcher, Mark R. and A.C. Budd. Heavy stands of goldenrod (Solidago spp.) and water hemlock (Cicuta) were treated with a one-half pound per acre application of 2,4-D ester on June 6, 1947 and again with a one and one-half pound rate on the same area on June 18, 1948. In both species the tops were quickly killed but a large amount of regrowth occurred and the original stand was duplicated the following spring. (Contribution from Dominion Experimental Station, Swift Current, Saskatchewan.)

Horsetail

Controlling field horsetail (Equisetum arvense L.) with 2,4-D. Wood, H.E. and J. J. Bourns. Trials conducted during 1950, on heavy clay soil, 20 miles north-west of Winnipeg on a dense stand of this weed not seeded to crop, confirm results reported in 1948-49, as follows: (1) While offering considerable resistance the weed responds rather better to the ester formulation than to the amine at dosages from 8 ounces acid upward; (2) When treatment was made before all plants had fully emerged re-treatment was required to obtain complete eradication. (Contribution of the Weeds Commission, Manitoba Department of Agriculture.)

Lettuce, blue

The effect of 2,4-D on blue lettuce in creeping red fescue. Macdonald, D.J. The butyl ester of 2,4-D was applied at 4, 8, 12 and 16 ounces acid equivalent per acre to a well-established infestation of blue lettuce (Lactuca pulchella) at bud, flower and partially dormant (autumn) stages. The experiment was commenced in 1949 when the grass was seeded with a nurse-crop of wheat. All treatments were made under satisfactory weather conditions. Rates of 8 ounces and more applied in 1949 at the bud stage reduced weed competition sufficiently to permit vigorous stands of fescue to develop on these plots. The fescue was not affected by any treatment. Weed kills obtained in 1950 from treatments made the previous year at

the bud stage were: 4 oz. - 45%; 8 oz. - 89%; 12 oz. - 93% and 16 oz. - 95%. The highest kills obtained at the flower and partially dormant stages were 29% and 38%, respectively. Dosages of 8 ounces and higher at the bud stage proved the only effective control measure. (Contribution of Dominion Experimental Station, Beaverlodge, Alberta.)

Nettle, horse

Response of Horse Nettle (Solanum carolininse) to treatments of 2,4-D and 2,4,5-T. Lee, Oliver C. Replicated plots of horse nettle were sprayed with 2,4-D, 2,4,5-T and a mixture containing equal parts of 2,4-D and 2,4,5-T. Two formulations of 2,4-D were used, isopropyl ester and polypropylene glycol butyl ether ester. All materials were applied at rates of 2 and 3 pounds of acid per acre when the horse nettle was in the full bloom stage of growth. Observations were made 90 days after spraying. Both 2 and 3 pounds of 2,4,5-T destroyed all top growth and root parts leading down to the lateral. The lateral roots appeared to be only slightly effected by the treatment. The combination of 2,4-D and 2,4,5-T proved to be more effective than 2,4-D but did not produce as satisfactory a kill as 2,4,5-T. The 3-pound rate produced approximately the same results as the 2-pound rate of 2,4,5-T. 2,4-D applied at rates of 3 pounds of acid per acre destroyed the top, and no resprouting occurred. The 2-pound rate of 2,4-D was not adequate to kill all tops. A few plants produced fruit on plots sprayed with 2 pounds of isopropyl ester. The polypropylene glycol butyl ether ester appeared to be slightly more effective than the isopropyl ester. Results of these treatments will be checked again next year at which time it will be possible to determine the percentage of surviving plants. (Contribution of Agricultural Experiment Station, Purdue University.)

Effect of date of spraying on horse nettle control. Hoffmann, O.L. and E.P. Sylvester. Observations were made on horse nettle sprayed in 1949 with a 50-50 mixture of 2,4-D and 2,4,5-T. Spraying dates were June 20, July 12, August 5, and September 13. Over 90 percent control of horse nettle was obtained by spraying on June 30 or July 12. Little or no control was obtained by spraying August 5 or September 13. It would appear that spraying before the late flowering stage is desirable. (Contribution of Iowa State College.)

Ragweed, bur

The effect of Polybor and Polybor-chlorate on bur ragweed. Woestemeyer, V. W. Polybor and Polybor-chlorate were sprayed on unreplicated square rod plots of bur ragweed June 21, 1950. The plots were located along a road ditch and shoulder on a very heavy soil. The materials were each applied in a solution containing 1½ pounds material per gallon of water. Plant counts taken October 6, 1950, for Polybor at 3, 4, 6 and 8 pound rates were 600, 350, 200 and 35 plants per square rod respectively and for Polybor-chlorate, 450, 500, 55 and 40 plants respectively at the same rates. On the 4, 6 and 8 pound plots of Polybor-chlorate and 6- and 8-pound plots of Polybor, all surviving plants were located on the upper edge of the plot along the slope. Most plants on the other plots were also located on the slope. Approximately 20 inches of rain fell in a five-week period beginning June 26. (Contribution of Kansas Agricultural Experiment Station.)

The effect of 2,4-D and 2,4,5-T on bur ragweed. Woestemeyer, V.W. and J.W. Zahnley. An experiment using 2,4-D and 2,4,5-T on bur ragweed (Franseria tomentosa) was begun in 1950 on quadruplicate randomized square rod plots. Applications were made at what was considered full emergence (May 27), but (June 25), and bloom (August 25) stages of growth. May and August treatments were 1 pound 2,4-D ester in water and 1 pound 2,4-D ester in an emulsion containing 2 gallons of No. 2 diesel fuel per acre. June applications were ½, 1 1½ and 2 pounds of amine and ester of 2,4-D and ester of 2,4,5-T per acre in water, and of micronized acid, amine and ester of 2,4-D in emulsions as above. Roots were examined on May and August plots and ½ and 1½ pound June plots. May treatments resulted in 100 percent kills of existing top growth and root kills to a depth of 17 inches. The 2,4-D in oil showed yellow leaves and slightly quicker response than 2,4-D in water. Ten to twenty percent late emergence followed these applications. From June treatments, the amine and ester of 2,4-D in oil gave complete top kills at 1 pound with amine giving root kills to 17 inches at ½ pound and ester giving 14 inch root kills at 1½ pounds. The esters of 2,4-D and 2,4,5-T gave 100 and 90 percent top kills, respectively, at the 1½ pound rate, with 14 inch root kills at ½ pound of 2,4-D and 7 inch root kills with occasional regrowth from 1½ pounds 2,4,5-T. Amine in water gave moderate injury to top growth at heavy rates with slight kills, while micronized acid in oil was somewhat less effective. Plants matured normally after August 25 Treatments. (Contribution of Kansas Agricultural Experiment Station.)

Toad flax

Effects of various herbicides on Toad Flax. Corns, W.G. Some replicated plots of roadside toad flax were sprayed with Dow TCA at 120 and 240 lb. acid equiv. in 300 gal. water per acre. Other plots received 2,4-D low volatility ester (Dow H-1010), 2,4-D ester (Naugatuck), 2,4-D acid (Amer. Chem. Paint 472), 2,4,5-T low volatility ester (Dow), 2,4,5-T ester (Naugatuck), Brush Killer low volatility esters of 2,4-D and 2,4,5-T (Dow) and Brush-Bane (Naugatuck) at 2 and 4 lb. acid equiv. in 75 gal. water per acre applied May 24 when plants 6-12" tall in vegetative stage. TCA killed top growth of quack grass present and prevented its regrowth but caused only temporary burning of toad flax. 2,4-D acid (ACP 472) was almost totally ineffective against toad flax. All the ester forms and rates of 2,4-D, 2,4,5-T and their mixtures killed nearly all top growth of toad flax but extensive regrowth occurred. On July 18 when check plots were near flowering, regrowth in 2,4-D and 2,4,5-T ester plots was sprayed with 1 and 2 lb. acid equiv. per acre and again a month later with 8 oz. and 1 lb. acre equiv. per acre. At the close of the season plants were vegetative, stunted, unthrifty, slightly reduced in numbers, but with apparently viable roots. Toad flax in a second set of plots treated with an initial application of 4 oz. acid equiv. of 2,4-D's and 2,4,5-T's on July 18 (near flowering) and with a second application at same rate a month later was stunted but final observations indicated strong potential for regrowth. (Contribution of Department of Plant Science, University of Alberta, Edmonton.)

Effect of 2,4-D on toad flax (Linaria vulgaris) on land not in crop. Friesen, H. A. In 1949 and again in 1950 the ester and amine formulations of 2,4-D were sprayed on toad flax in the bud-flowering stage at the rates of ½, ¾, 1 2 and 3 pounds of acid equivalent per acre. The toad flax patches were located in the black soil zone on loam-textured soil. The stand of toad flax in the patches averaged 350 shoots per square yard. Although the 1949 treatments resulted in as high as 80 percent killing of the top growth, for the three heaviest rates of application used, the roots did not appear to be killed to a depth of more than three inches. Consequently, regrowth during the fall of 1949 and the spring of

1950 was as abundant on the treated plots as it was on the original stand. The effects of retreating the same plots with the same rates and formulations of 2,4-D in 1950 tended to follow a similar pattern as had been observed in 1949. Indeed, the regrowth was so dense by late August that all of the plots, including the checks were tilled to a depth of six inches. It was of interest to observe that on the treated strips regrowth was negligible on October 12, 1950, while on the untreated check the regrowth was an estimated 75 percent of the original stand. While the retarded emergence would indicate a weakening of the roots by the 2,4-D treatment, the true effect cannot be measured until the spring of 1951. (Contributed by the Dominion Experimental Station, Scott, Saskatchewan.)

Effect of 2,4-D on toad flax (Linaria vulgaris) on land seeded down to crested wheat grass (Agropyron cristatum). Friesen, H.A. A two acre plot containing some 50 patches of toad flax was seeded to crested wheat grass in the late fall of 1948. The patches averaged 400 square feet in size and had an average of 300 shoots per square yard. In early June of 1949, two portions of the seeded area were sprayed, one with 6 ounces per acre of an ester and the other with 6 ounces per acre of an amine of 2,4-D, in water solution. Both formulations used resulted in only a very temporary stunting of the top growth, hence the sprayings did not materially reduce toad flax competition and thereby facilitate the establishment of the grass seedlings in the patches. In mid May of 1950, the plot area not covered by toad flax had a good cover of grass, however in the patches themselves the "catch" of grass was very poor. The plot area treated with amine, in 1949, was sprayed in May, 1950, with amine in water at the rates of viz: ½, ¾, 1 and 1½ pounds of acid per acre. The area treated with ester in 1949 was retreated with ester using the rates as given for amine. Good top kills resulted from all rates but by mid July regrowth was equal to the original stand. Consequently, the previously treated amine plots were re-treated in July with amine at 3 pounds and the ester plots which had received ½, ¾, 1 and 1½ pounds were retreated with the ester at 1, 2, 3 and 4 pounds of acid per acre. The 3 and 4 pound rates of ester were in diesel oil rather than water. In October, 1950, the amine at 3 pounds and the ester at 3 and 4 pounds had 15 percent regrowth while ester at 1 and 2 pounds had 85 percent regrowth. The roots did not appear to be affected to a depth of more than 4 inches. (Contributed by the Dominion Experimental Station, Scott, Sask.)

Common Name	Scientific Name	Herbicide and application per acre	State or Province	Spring Growth	Bud	Bloom	Fall Growth	Classification
Alfalfa	Medicago sativa	Na TCA 50 lb.	Ohio			III		III
Artichoke, Jerusalem	Helianthus tuberosus	Na TCA 50 lb	Ohio	I				I
Asparagus	Asparagus officinalis	Na TCA 50 lb.	Ohio	IV				IV
Aster	Aster sp.	E 2,4-D ½,1 lb.	S.D.	IV	IV			IV
	Aster multiflorus	E 2,4-D 1½ lb.	Kans.	III				III
Bindweed, field	Convolvulus arvensis	E,A,S 2,4-D 1 lb.	Kans.	II	II	II	II	II
		Na chlorate 4-5 lbs. 1 sq. rd.	Kans.	I	I	I	I	I
		Borascu 25-30 lbs. 1 sq. rd.	Kans.	I	I	I	I	I
		E,A,S 2,4-D 1 lb.	Kans.		II	II	II	II
		E 2,4-D 1 lb.	Man.			I-II		I-II
		E,A 2,4-D ¼ lb. ½ lb. 1 lb.	Nebr.	 III II	III II II	 III III	 II II	II

E = ester; A = amine; S = sodium salt.

Common Name	Scientific Name	Herbicide and application per acre	State or Province	Spring Growth	Bud	Bloom	Fall Growth	Classification
Bindweed, field (continued		E 2,4-D 2 lb.	Sask.			I		I
		E,A,S 2,4-D 1 lb.	Wisc.	II	II	II	II	II
		2,4,5-T ½ lb.	S.D.	II	II	II	III	II
		E,A,S 2,4-D ½ lb.	S.D.	II	II	II	II	II
Bindweed, hedge	Convolvulus sepium	Na TCA 200 lb.	Ohio	IV				IV
Boneset, false	Kuhnia sp.	E 2,4-D 1½ lb.	Kans.	IV				IV
Bluegrass, Kentucky	Poa pratensis	Na TCA 25 lb.	Ohio	I				I
Blueweed	Echium vulgare	E 2,4-D ½ lb.	Ont.	I		I	I	I
		E 2,4-D + 2,4,5-T	Ont.	I		I	I	I
Brier, sensitive	Schrankia uncinata	E 2,4-D 1½ lb.	Kans.		IV			IV
Buttercup, tall	Ranunculus acris	E 2,4-D 1, 2 lb. 4 lb.	B.C.		III II			II
		M.C.P. 2 lb.	B.C.		II			II
		2,4,5-T 1 lb. + E 2,4-D 1 lb.	B.C.		II			II

Common Name	Scientific Name	Herbicide and application per acre	State or Province	Spring Growth	Bud	Bloom	Fall Growth	Classification
Cactus, prickly pear	Opuntia sp.	2,4,5-T 2-5% sol. in oil	S.D.	I				I
		TCA 1 lb./gal. sol.	S.D.	I				I
Campion, bladder		E,A,S 2,4-D ½, 1, 2 lb.	Man.	III	III			III
Cherry, ground	Physalis sp.	E 2,4-D 3 lb.	Kans.		IV	IV		IV
Chickweed	Cerastium vulgatum	E,A 2,4-D ½ lb.	S.D.	II	II	II	II	II
Clover, red	Trifolium pratense	Na TCA 50 lb.	Ohio			II		II
Clover, white	Trifolium repens	Na TCA 50 lb.	Ohio			III		III
Cockle, white	Lychnis alba	E 2,4-D 1 lb.	Alta.	I (seedlings)				I
Creeper, trumpet	Campsis radicans	Na TCA 200 lb.	Ohio	IV				IV

Common Name	Scientific Name	Herbicide and application per acre	State or Province	Spring Growth	Bud	Bloom	Fall Growth	Classification
Cress, Austrian field	Rorippa austriaca	A 2,4-D ½ lb.	Wisc.		I	I		I
Cress, hoary	Lepidium draba	E,A,S, 2,4-D ½, 1, 2 lb.	Man.	Five applications of ½ to 1 lb. necessary for eradication				II-III
		E 2,4-D 2 lb.	Sask.		II			II
		Atlacide 500, 1000, 1500 lbs.	Man.	II	II	Two applications necessary for eradication		II
Daisy, ox-eye	Chrysanthemum leucanthemum	E 2,4-D ½ lb.	Ont.	II		II	II	II
		2,4,5-T ½ lb.	Ont.	II		II	II	II
		E 2,4-D + 2,4,5-T ½ lb.	Ont.	II		II	II	II
Dandelion	Taraxacum officinale	E,A 2,4-D 2/3 to 1 lb.	Kans.		I	I		I
		E,A 2,4-D ½, 1 lb.	S.D.	II	II			II
		Na TCA 100 lb.	Ohio	IV				IV
	T. palustre	E,A 2,4-D ½ lb.	Wisc.	I	I	I	I	I
Dock, curled	Rumex crispus	E,A 2,4-D ½ lb.	S.D.	II				II

Common Name	Scientific Name	Herbicide and application per acre	State or province	Spring Growth	Bud	Bloom	Fall Growth	Classification
Goldenrods	Solidago spp.	E,A 2,4-D 1lb.	S.D.	III	III			III
Grass, couch	Agropyron repens	TCA 40 lb.	Wisc.	III			II	
		80 lb.	Wisc.	II			I	I
		80 lb.	Sask.				I	I
		100 lb.	Man.	I	I	I	I	I
		LPC 100 lb.	Sask.				I	I
		Chlorosol A 55 lb	Sask.				II	II
		100 lb					I	I
		Petroleum oil 100 gal.	Sask.				IV	IV
Grass, northern nut	Cyperus esculentus	Na TCA 50 lb.	Ohio	I				I
Grass, slough	Spartina pectinata	TCA 24, 48, 72 lb.	Nebr.	II	II	II	II	II
Hawkweed, orange	Hieracium aurantiacum	A 2,4-D 1 lb.	Wisc.	I				I

Common Name	Scientific Name	Herbicide and application per acre	State or province	Spring Growth	Bud	Bloom	Fall Growth	Classification
Knapweed, Russian	Centaurea repens	E 2,4-D ½, 1, 2 lb.	Man.		II	II		II
		E 2,4-D 1 lb. 2, 4 lb.	Nebr.	---	IV III			III
		E,A 2,4,5-T 1 lb 2, 4lb.	Nebr.		IV III			III
		2,4-D + 2,4,5-T 1 lb. 2, 4 lb.	Nebr.		IV III			III
		2,4-D acid dry 10 lb. 20, 30 lb.	Nebr.				II I-II	I-II
		E 2,4-D 1 lb.	Sask.		II			II
		E,A 2,4-D ½ to 1½ lb.	S.D.	IV				IV

Common Name	Scientific Name	Herbicide and application per acre	State or province	Spring Growth	Bud	Bloom	Fall Growth	Classification
Lettuce, blue	Lactuca pulchella	E 2,4-D 5/8 lb.	Alta.		II			II
		E,A 2,4-D ½-¾ lb	S.D.	II	II			II
		E, 2,4-D 2 lb.	Sask.	II				II
Milkweed, common	Asclepias syrica	A 2,4-D 1 lb.	Wisc.	IV	IV	IV		IV
Milkweed, whorled	A. verticillata	A,S 2,4-D 1 lb.	Wisc.		III			III
Nettle	Urtica dioica	E,A,S 2,4-D 1lb.	Wisc.	II	II	II		II
Nettle, horse	Solanum carolinense	E,A 2,4-D ½, 1 lb.	S.D.	IV				IV
Plantain, buckhorn	Plantago lanceolata	A,E 2,4-D ½ lb.	Wisc.		I	I		I
Plantain, common	P. major	AES 2,4-D ½ lb.	Wisc.	II	I	I		I
Plantain, Rugel's	P. rugellii	AES 2,4-D ½ lb.	Wisc.	II	I	I		I
Ragweed, bur	Franseria tomentosa	E 2,4-D ¾-1lb.	S.D.	III	III		III	III
		2,4,5-T ¾-1 lb.	S.D.	III	III		III	III
Ragweed, perennial	Ambrosia psilostachya	E 2,4-D 1 lb.	Kans.	I				I
		¾-1½ lb.	S.D.	II	II			II
		2,4,5-T ¾-1½ lb.	S.D.	II	II			II

Common Name	Scientific Name	Herbicide and application per acre	State or province	Spring Growth	Bud	Bloom	Fall Growth	Classification
Rose	Rosa sp.	2,4-D (2 parts) + 2,4,5-T (1 part) 2 lb. 4 lb.	Sask.	II I				I
Sage, pasture	Artemisia frigida	E 2,4-D 2 lb.	Sask.	II				II
Sage, prairie	A. gnaphalodas	E 2,4-D 2 lb.	Sask.	II				II
Snowberry, western	Symphoricarpos occidentalis	E 2,4-D 1½ lb.	Man.	I-II				I-II
		E,A 2,4-D + 2,4,5-T ½-1½ lb.	S.D.	III	IV	IV		III
		2,4-D (2parts) + 2,4,5-T (1part) 2 lb. 4 lb.	Sask.	III II				II
Spurge, flowering	Euphorbia corollata	TCA 80 lb.	Wisc.			IV		IV

Common Name	Scientific Name	Herbicide and application per acre	State or province	Spring Growth	Bud	Bloom	Fall Growth	Classification
Spurge, leafy	E. esula	E 2,4-D 1 lb. 2 lb.	Man. Sask.			III II		III (top growth only) II
		E,A 2,4-D 1,2 lb ½-1 lb	Nebr. S.D.	III III	III II	. III	III III	III II
		E,A,S 2,4-D ½, 1, 2 lb.	Man.	Five applications of ½-1 lb necessary for eradication				II-III
		2,4,5-T 1,2 lb	Nebr.	III	III			III
		½ E 2,4-D + ½ 2,4,5-T ½, 1 lb.	Nebr.	III	III			III
		2,4-D acid dry 10 lb. 20, 30 lb.	Nebr.	II I			II I	II I
		Borascu dry 15 lb./sq. rod 10 lb./sq. rod 20,30 lb/sq. rod	S.D. Nebr. Nebr.	I II I	I	II	I II I	I I
		Borascu, concentrated 10-12 lb./sq. rod	S.D.	I	I	II	I	I
		Chlorax 4,5 qt/sq rod 6 qt./sq. rod	Nebr.	II			I I	I
		Atlacide 500, 1000, 1500 lb.	Man.	I	I			I

Common Name	Scientific Name	Herbicide and application per acre	State or province	Spring Growth	Bud	Bloom	Fall Growth	Classification
Spurge, leafy (continued)		Polybor 10, 15 lb/sq. rod	S.D.	I	I	II	I	I
		Polybor chlorate 8-10 lb/sq. rod	S.D.	I	I	II	I	I
Thistle, Canada	Cirsium arvense	E 2,4-D ½, 1, 2, 3 lb. 1 lb.	Man. Man.	I	I II	I		I II
		E,A 2,4-D ½-¾ lb.	S.D.	II	II	III	II	II
		E,A,S 2,4-D 1 lb.	Wisc.	II	II	III	III	II
		2,4-D acid 1 lb.	Sask.			II		II
		E 2,4,5-T 1 lb.	Wisc.	II	II	III		II
		TCA 80 lb.	Wisc.	IV				IV
Thistle, nodding	Carduus nutans	E 2,4-D ½ lb.	Ont.	I		I	I	I (Cotyledons II)
		2,4,5-T ½ lb.	Ont.	I		I	I	I (Cotyledons III)
		E 2,4-D + 2,4,5-T ½ lb.	Ont.	I		I	I	I (Cotyledons III)

Common Name	Scientific Name	Herbicide and application per acre	State or province	Spring Growth	Bud	Bloom	Fall Growth	Classification
Thistle, perennial sow	Sonchus arvensis	E 2,4-D ½, 1, 2, 3 lb.	Man.	I	I	I	I	I
		1 lb.	Man.		II			II
		½-¾ lb.	S.D.	II	II			II
		A 2,4-D ½-¾ lb.	S.D.	II	II			II
		1 lb.	Sask.		I			I
Toad flax	Linaria vulgaris	E 2,4-D + 2,4,5-T 2 lb.	Sask.	III				III

PROJECT II. CONTROL OF ANNUAL, WINTER ANNUAL, AND BIENNIAL WEEDS

Annual and winter annual grassy weeds. Investigation Leader: Neal E. Shafer

Summary

Fourteen abstracts were received under this project; eight included crabgrass, five reported on foxtail, three included work on weedy bromes, and one each reported on barnyard grass and wild oats. Five reported two or more species. E.H.#2 with two applications of 4 pounds each gave almost complete control of crabgrass without injury to bluegrass. At 12 pounds E.H.#2 pre-emergence on muskmelons and 6 pounds and 12 pounds on sweet potatoes killod 75 percent to 80 percent of crabgrass in the melons and 85 percent to 90 percent in sweet potatoes. No injury occurred on muskmelons but sweet potatoes were severely injured, although normal growth was resumed in 6 to 10 weeks. Yield of sweet potatoes was significantly reduced at the 12-pound rate of E.H.#2. N-1-naphthyl phthalamic acid at 2 pounds and 4 pounds gave equivalent crabgrass control without injury to either muskmelons or sweet potatoes. In a greenhouse study both E.H.#1 and E.H.#2 gave less than 75 percent control of four annual weedy grasses including crabgrass. Frequent light watering may have influenced results. TCA at 2 pounds does not appear to be enough and 4 pounds did not always give good control. Injury of muskmelons and sweet potatoes was reported as serious.

At rates of 6, 8, and 12 pounds TCA destroyed crabgrass and bluegrass. Maleic hydrazide either did not control crabgrass or seriously injured bluegrass, muskmelons, or sweet potatoes in reports from Michigan, Indiana, and Nebraska. KOCN at 8 pounds to 12 pounds gave 70 percent to 90 percent control of crabgrass as reported from two stations. Bluegrass was injured but recovered in 2 to 4 weeks. A similar tolerance was reported on ten varieties of bent grass. PMA at an undesignated rate controlled crabgrass but injured bluegrass. Six applications of 10 and 15 ounces per acre of PMA did not control crabgrass. Among the most promising treatments reported on crabgrass were S-1998 at 2 percent, Dow Premerge at 6 quarts per acre, Standard crabgrass spray oil, and ordinary kerosene. Results of 86 percent to 98 percent control were reported with little or no injury to bluegrass. Three applications of Scutl (8 pounds per 1250 square feet) and Dow Premerge at 3 quarts per acre gave approximately 70 percent control.

Crabgrass and foxtails were controlled 50 percent to 60 percent by applications in corn at lay-by of Dow Premerge 3 and 6 quarts, Sodium PCP at 16 pounds, 2,4-D free acid, and 2,4-D amine. E.H.#1 at 4 pounds, IPC and chloro IPC at 3 and 6 pounds and PCP at 12 pounds gave less than 50 percent control. Both IPC materials severely inhibited stalk development above the ear.

One report compared the competition effects of grassy weeds and broadleaf weeds on yields of flax and showed the broadleaf weeds caused a greater reduction in flax yield. Treatment with 3/4 pound of endothal gave a significantly higher yield of flax than where foxtail, wild oats, and others were untreated in the flax. Endothal did not affect flax yields and thus appears promising on this weed problem. Other promising results of work on foxtails in flax were reported following the use of TCA. Rates of 10 pounds and 13 1/2 pounds gave 80 percent to 85 percent control on setaria species 2 to 5 inches high. A combination of 5 pounds TCA and 1/4 pound 2,4-D gave 60 percent control of foxtail and satisfactory control of broadleaved weeds. Trials on larger foxtail gave 96 percent to 99 percent control of foxtail. Addition of 1/4 pound 2,4-D amine controlled mustards satisfactorily with no apparent injury to flax varieties (B-5128) and Koto.

Foxtail and barnyard grass were effectively controlled in an alfalfa seed field following removal of the first cutting with treatments of 8 pounds of E.H. 5722 and 10, 15, and 20 pounds of TCA. P.E.C. at 2 and 4 gallons in tractor fuel and 3 pints Sinox General in oil killed all grassy weeds present but did not control later germination. E.H. 5722 was partially effective at 2 pounds and 4 pounds, while N.I.X. at 15 pounds and 30 pounds and Sinox General in water were ineffective. Some injury occurred to alfalfa shoots present at spraying time but did not appear on later emerging shoots.

Downy brome and hairy chess were 90 percent eliminated by spring applications of TCA at 10 pounds and 15 pounds and IPC at 20 pounds. Only 3 pounds of TCA when combined with 3 pints of Sinox General gave 90 percent control applied in the fall and 80 percent control applied in the spring. None of the materials or combinations were sufficiently selective for use in grass seed fields. As low as 10 pounds TCA applied in the fall completely eliminated downy brome in alfalfa but as high as 100 pounds did not eliminate quack grass. DNOSBP at 1 to 3 pints in 10, 15, and 20 gallon oil emulsified up to 100 gallons with water gave no control of either grass. Alfalfa was slightly stunted the following spring where 75 pounds and 100 pounds TCA had been applied but stunting was not apparent at the time of first cutting.

Abstracts of Results of Cooperators

An ecological study of the effects of 2,4-D, endothal and annual weeds on flax yields at Brookings, S. Dak. in 1950. Derscheid, Lyle A., J. M. Aikman. Quintuplicate, 8'x16', plots were seeded to Dakota flax in rows six inches apart. Three plots were kept weed-free, three were seeded to wild mustards and foxtails primarily, but some wild oats, wild buckwheat, shepherd's purse, lambs quarter and sweet clover were also seeded. A seventh plot was seeded to the broadleaved weeds and an eighth to the grassy weeds. Plots 7 and 8 as well as one weed-free and one mixed weedy plot were not treated with chemicals. One weed-free and one mixed weed plot were treated with the alkanol amine of 2,4-D at the rate of 1/4 lb. of acid equivalent per acre. Two similar plots were treated with 3/4 lb. of 3,6-endoxyhexahydrophthalic acid equivalent (endothal) per acre. Yields of flax straw, flax seed, broadleaved weed shoots and grassy weed shoots were taken from 4 rows 13 ft. long. The data were analyzed statistically. Flax seed and straw yields varied together and were not affected by either chemical. Mean yields of 22.8 bu/A and 0.63 T/A from weed-free plots were significantly higher than mean yields of 15.6 bu/A and 0.42 T/A from weedy plots. The yields of 18.9 bu/A and 0.51 T/A from grassy weed plots were significantly higher than the mean yields of 14.7 bu/A and 0.40 T/A from plots containing broadleaved weeds. The mean yield of broadleaved weeds of 0.47 T/A from 2,4-D treated plots was significantly lower than the mean yield of 0.65 T/A from untreated plots. The yield of grassy weeds of 0.15 T/A from endothal treated plots was significantly lower than the mean yield of 0.30 T/A of untreated plots. When grassy weeds were partially controlled with endothal, the broadleaved weed yield increased 0.19 T/A. Due to unusually cool and otherwise abnormal growing conditions, 2,4-D was not as effective as usual and therefore the effect of endothal may not have been typical. Endothal should, therefore, be tested further before it can be recommended for general use. (Contribution of Agronomy Department of South Dakota Agricultural Experiment Station in cooperation with the Botany Department at Iowa State College.)

Effect of dichloral urea (E. H. No. 2) on crabgrass in lawns. Earhart, C. W. and C. J. Willard. In the course of some tests on crabgrass which for various reasons were not satisfactory, results with E.H. No. 2 seem worth noticing. Applications of 4, 8, and 12 pounds per acre were applied June 21 (rather dry conditions for the

season) and repeat applications of the same rates on the same plots July 7. The la ter part of the season was wetter than normal and in August crabgrass came on vigor ously in the untreated areas. All E.H. No. 2 treated plots were essentially free o crabgrass - only 3 or 4 plants per sq. rod left in the 4 lb. plots. Bluegrass here was not injured in the 4 lb. (actually 8 lb.) plots, but was burned and stunted in the others - partially killed out in one. Later applications uniformly resulted in damage to the bluegrass - more than the average lawn owner would tolerate - but the lead may be worth following up. (Contribution of the Ohio Agricultural Experiment Station.)

Effect of several herbicides used for control of weedy grasses in growing co Finnerty, D. W. Seven chemicals were applied to corn in place of a final cultivation on July 21. Materials were applied in water at 80 gpa. Spray touched only the lower part of the corn stalk. Three replications in a randomized block design were used. Chemicals and rates were: Dow Premerge, 3 and 6 quarts per acre; Carbide and Carbon E.H.#1, 4 pounds; IPC, 3 and 6 pounds; chloro IPC, 3 and 6 pounds; Sodium PCP 12 and 16 pounds; 2,4-D free acid, 2 pounds; and 2,4-D amine, 2 pounds. Soil was moist, corn and weeds growing actively at time of treatment. Crabgrass and foxtails were in 2-leaf stage between corn rows and 2-leaf to heading in the rows. Observations September 12 showed four of the materials gave an estimated 50% or more contro Dow Premerge, 3 quarts, 50% control; 6 quarts, 60%; Sodium PCP, 16 pounds, 50% control; 2,4-D free acid, 2 pounds, 55%; and 2,4-D amine, 2 pounds, gave 55% control. None of the treatments used appeared to affect the corn, except that corn in plots receiving 6 pounds of either IPC or chloro IPC was 3 to 4 feet shorter than untreated plants. (Contributed by Nebraska Agricultural Experiment Station, Lincoln, Nebraska

Effect of several chemicals applied as pre-emergence and post-emergence treatments on crabgrass in a bluegrass lawn. Finnerty, D. W. and N. E. Shafer. Eleven chemicals were used in four tests conducted at different periods throughout the summer of 1950. Timeliness of initial treatments and optimum time for retreatments were observed. Repeated applications of most chemicals were made to replicated plots in randomized blocks. Extremely dry weather during June and subsequent cool, damp weather during July and August could have affected the results of the tests. Foliage treatments were: kerosene, 2 and 3 quarts per square rod; S 1998, 1 and 2 percent in 600 gallons water per acre; Aero cyanate 0.5 and 1.0 percent in 150 gallons water per acre; Scutl, 4 pounds per 1250 square feet and 8 pounds per 1250 square feet; and maleic hydrazide, 0.2, 0.4, and 1.2 percent in 150 gallons water per acre. Pre-emergence treatments, which were all applied in 150 gallons water per acre, were: 2,4-D free acid, 2 and 3 pounds, 2,4-D amine, 2 and 3 pounds; Dow Premerge, 3 and 6 quarts; IPC, 3 and 6 pounds; Carbide and Carbon E.H.#1, 4 and 6 pounds; and chloro IPC, 3 and 6 pounds per acre. Rates, dates of application (initial and retreatments), and percent kill (based on head counts September 9) for treatments giving best control with negligible injury to bluegrass were: Dow Premerge, 6 quarts, May 16 and July 13, 98% S 1998, 1%, May 22, June 22, and July 13, 86%; S 1998, 2%, May 22, June 22, 90%, kerosene, 2 quarts per square rod, July 13, 90% and kerosene, 3 quarts per square rod, August 11, 95%. Other treatments giving less satisfactory control were: Aero cyanate 1.0%, May 22, June 22, and August 11, 70%; Dow Premerge, 3 quarts, May 16, July 13, August 11, 73%; and Scutl, 8 pounds per 1250 square feet, July 24, August 2, August 11 74%. All other treatments either were ineffective in controlling crabgrass or were too injurious to bluegrass. (Contributed by Nebraska Agricultural Experiment Statio Lincoln, Nebraska.)

Effects of herbicidal treatments used for control of weedy bromes. Finnerty, D. W., D. L. Klingman, and N. E. Shafer. All materials were applied at volumes of 100 and 150 gallons of spray per acre late in the fall and early in the spring. IPC applied at 10 pounds per acre gave 60% to 70% control for spring and fall treatments, respectively; 20 pounds gave 87% and 90%. Sodium TCA at 10 pounds and 15 pounds gave better than 90% control. The addition of 3 pints Sinox General to 10 pounds IPC gave 67% and 84% control for spring and fall applications; when 3 pints Sinox General was combined with 3 pounds STCA, it gave 89% and 80% control; with 5 pounds STCA, 91% and 82%; and with 10 pounds STCA gave 98% and 94% control. Sinox General alone at 3 pints per acre gave 25% and 12% control. Relatively good initial kills of seedlings were secured with Sinox, but seeds germinating subsequently were largely responsible for the poor control shown. Temporary soil sterilants were added to the contact herbicide to provide some residual effect. The above combinations were successful in giving good control of the weedy bromes but also injured the perennial grass species considerably. All rates of IPC or TCA which gave 80% or better control of weedy bromes reduced smooth bromegrass stands by from 16% to 93%. None of the materials used in these experiments gave satisfactory selective control in perennial grass stands; however, IPC and TCA did give satisfactory control of the weedy bromes either alone or in combination with contact herbicides. (Contribution of the Nebraska Agricultural Experiment Station and the Division of Weed Investigations, B.P.I.S.A.E., cooperating.)

Herbicides for the selective control of crabgrass. Grigsby, B. H. Lawn plots containing crabgrass were sprayed in July with Standard crabgrass spray oil, KOCN, PMA, TCA, Maleic hydrazide, and combinations of all the later compounds with the crabgrass spray oil. The results were determined by counting the number of crabgrass seed heads present in the treated areas one month following the treatment. Two applications of the crabgrass spray oil prevented grass seed head formation and did not injure lawn grasses. KOCN and PMA gave satisfactory control of crabgrass when applied to young plants but caused some injury to lawn grasses. Recovery took place in 2-4 weeks' time. Maleic hydrazide at 2 lbs. per acre gave less than 50% reduction of seed heads but did not injure lawn grasses. TCA caused a 90% reduction when applied to young seedlings but was not effective on well established crabgrass. (Contribution from Michigan Agricultural Experiment Station.)

Application of TCA for the control of annual grasses in flax in 1950 at Milbank, South Dakota. MacDonald, W. P., C. C. Zinter, A. T. Slough. 90% sodium TCA was applied June 23 at 10 and 13½ lbs. of acid equivalent per acre. Also 5 lbs. of TCA was applied with 4 ounces of an alkanolamine 2,4-D. The 10-lb. rate was applied as a spray solution with 10 and 20 gals. of water per acre. All other plots were applied at 10 gals. of solution per acre. At the time of treatment the flax (B-5128) was 3 to 5 inches high, badly infested with setaria which was 2 to 5 inches high. No injury to flax was observed at any rate. Estimated control of setaria August 1, 1950: 13½ lbs., 85%; 10 lbs. (20 gals.), 83%; 10 lbs. (10 gals.), 80%; 5 lbs. TCA, 4 ounces 2,4-D, 60%. Control of annual broadleaves where the combination of chemicals was used was satisfactory and equal to a like quantity of 2,4-D used alone. (Contribution of Agr. Dept., F. H. Peavey & Co., Minneapolis, Minn.)

Application of TCA for the control of annual grasses in flax in 1950 at Danvers, Minn. MacDonald, W. P., C. C. Zinter, A. T. Slough. 90% sodium TCA was applied June 14 at the following rates of acid equivalent per acre - 10 lbs. in 20 gals. of water; 10 lbs. in 10 gals.; 5 lbs. in 10 gals.; and 10 lbs. with 4 oz.

alkanolamine of 2,4-D in 20 gals. of water. At the time of treatment the flax (Kot
was 5 to 6 inches high and heavily infested with setaria which was 4 to 6 inches hi
No injury to flax was observed at any rate. Estimated control of setaria Aug. 1.
1950 - 10 lbs. TCA & 20 gals. water, 98%; 10 lbs. & 10 gals., 99%; 5 lbs. & 10 gals.
96%; 10 lbs., 4 ounces 2,4-D and 20 gals., 97%. Where the combination of TCA and
2,4-D was used, control of mustard was satisfactory and equal to a like quantity of
2,4-D used alone. (Contribution of Agr. Dept.,F. H. Peavey & Co., Minneapolis, Mi

Response of crab grass (Digitaria spp.) and turf to herbicides. Oyer, E. B.
Four materials were applied to replicated plots located on an established golf cour
turf heavily infested with crab grass. The principle turf grasses were Kentucky
blue grass and Canada blue grass. Treatments included potassium cyanate, rates of 8
and 12 pounds per acre; phenyl mercury acetate, rates 10 and 15 ounces per acre;
sodium trichloroacetate, rates 6, 8, and 12 pounds per acre; and maleic hydrazide,
rates of 2, 4, and 8 pounds per acre. All treatments were applied in water at the
rate of 200 gallons per acre. First applications were made when crab grass was in
the two-leaf stage of growth. Two applications of potassium cyanate made at ten-day
intervals killed 90 per cent of the crab grass. The 12-pound rate caused considera
browning of the turf grass while the effect of the 8-pound rate was not pronounced.
The turf recovered rapidly and developed a dark green color as compared to checks.
After an interval of 30 days, plots were retreated to check the growth of new seed-
lings appearing in later summer and early fall. Six applications of phenyl mercury
acetate applied at 10-day intervals reduced the stand of crab grass, but control was
not satisfactory. This material did not injure the turf grasses. Sodium trichloro-
acetate at rates applied destroyed all grasses. Three applications of maleic hydra-
zide at rates of 4 pounds caused dwarfing and slight injury to turf grasses as well
as crab grass. The 8-pound rate produced some injury to all grasses. Rates tolerat-
ed by the turf grasses did not give satisfactory control of crab grass. A prelimi-
ary experiment was conducted to determine the possibility of controlling crab grass
in bent grass turfs. Ten varieties of bent grass were sprayed with the four mater-
ials mentioned. Bent grass apparently will tolerate the use of potassium cyanate
applied in sufficient quantity to destroy crab grass. (Contribution of Agricultural
Experiment Station, Purdue University.)

Toxicity of five chemicals applied as soil treatments. Shafer, N. E. and
D. W. Finnerty. Five chemicals were applied at three rates each to flats in a gree
house containing 100 germinating seeds of each of the following grasses: crabgrass,
downy bromegrass, yellow foxtail, and hairy chess. Chemicals were applied in water
at 40 gpa. Materials and rates were: IPC, 3, 6, and 9 pounds per acre; E.H.#1,
2, 4, and 8 pounds; E.H.#2, 4, 8, and 12 pounds; 2,4-D amine salt, 2, 4, and 6 pounds
and Dow Premerge, 3, 6, and 12 quarts per acre. Compared to untreated flats, seed-
ling survival counts taken two weeks following applications showed that all treat-
ments except E.H.#1 and #2 gave 78% control or better, with the exception of 2,4-D
amine salt on downy bromegrass, which gave only 59% control at 6 pounds per acre.
Dow Premerge at 6 and 12 quarts per acre and IPC at 6 and 9 pounds per acre gave kill
approaching 100% on all four grasses. (Contributed by Nebraska Agricultural Experi-
ment Station, Lincoln, Nebraska.)

Control of barnyard grass and green foxtail in seed alfalfa. Viehmeyer,
Glenn, R. E. Ramig, and L. C. Portz. Various herbicides, in a randomized block de-
sign of five replications, were applied to an established stand of alfalfa immediate-
ly following removal of the first cutting. Per acre dosages of 2 and 4 gals. of

P.E.C. (polychloro Aryl-alkyl carbonate) in tractor fuel; 15 and 30 lbs. of N.I.X. (Sodium isopropyl xanthate) in water; 10, 15, and 20 lbs. of TCA in water, 2, 4, and 8 lbs. of Carbide and Carbon's E.H. 5722 in water; and 3 pts. of Sinox General in water, 1 part oil to 3 parts water, and in oil alone were used. All chemicals were diluted to give an application rate of 60 gals. per A. Effects on barnyard grass (Echinocloa Crus-Galli, Beauv.), green foxtail (Setaria viridis, Beauv.), and the crop plant were observed. N.I.X. at both rates, and Sinox in water were ineffective. P.E.C. at both rates and Sinox in oil and in oil and water killed all vegetation above ground at time of application but failed to prevent reinfestation with grassy weeds from late-germinating seeds. E.H. 5722 was partially effective at the 2-and 4-pound rates, and gave complete control at the 8-lb. rate. TCA gave complete control at all rates. Both TCA and E.H. 5722 gave some control of (Kochia scoparia, Roth.) though no data were taken on degree of control secured. Crop injury in the form of tip-burn and distortion of leaves and stems of shoots above ground at time of treatment was observed. No such injury was apparent on shoots emerging after treatment. Seed yields were not taken due to the crop being destroyed by hail. The 1950 results appear promising, but additional studies on residual effects on soil, cumulative effect on the crop plant, and most effective dosages of TCA and E.H. 5722 must be made before recommendations for field use are made. (Contribution of North Platte Sub-Station, University of Nebraska.)

Crabgrass Control in Muskmelons. Warren, G. F. Purdue 44 muskmelons transplanted May 15 into a fine sand soil were sprayed June 6 with TCA at 2 and 4 lbs., maleic hydrazide at 4 lbs., dichloral urea at 6 and 12 lbs., and N-1-naphthyl phthalamic acid at 2 and 4 lbs. per acre. Treatments were replicated 4 times and all materials were applied in water at the rate of 50 gal. per acre. At the time of application, the muskmelons were in bloom but no fruit had set and all weeds had been removed by cultivation and hoeing. Several showers of less than one-half inch each occurred during the three weeks after spraying. Dichloral urea at 12 lbs. and N-1-naphthyl phthalamic acid at both rates gave 75 to 80 percent reductions in crabgrass (Digitaria spp.) counts made August 22. Dichloral urea at 6 lbs. gave a 55 percent and TCA at both 2 and 4 lbs., a 42 percent reduction compared with the check. The maleic hydrazide treatment resulted in a large increase in the crabgrass population which was apparently due to the fact that this treatment stopped growth of the muskmelon plants for about three weeks, resulting in less shading of the ground. The other treatments caused little or no apparent injury to the muskmelon foliage. The total yield of melons was not significantly affected by any treatment except maleic hydrazide which resulted in almost a complete crop failure. However, maturity was delayed considerably by TCA at the 4-lb. rate. N-1-naphthyl phthalamic acid and dichloral urea were the most promising materials included in this experiment for the control of crabgrass in muskmelons. (Department of Horticulture, Purdue University, Agricultural Experiment Station, Lafayette, Indiana.)

Crabgrass Control in Sweet Potatoes. Warren, G. F. Yellow Jersey sweet potatoes transplanted May 8 into a fine sand soil were sprayed May 16 with TCA at 2 and 4 lbs., dichloral urea at 6 and 12 lbs., maleic hydrazide at 4 lbs., IPC at 8 and 16 lbs., and N-1-naphthyl phthalamic acid at 2 lbs. per acre. Treatments were replicated 4 times and all materials were applied in water at the rate of 50 gal. per acre. Only a small percentage of the crabgrass (Digitaria spp.) had emerged when sprays were applied. Rainfall totalling 1.05 inches occurred May 21. TCA at 4 lbs., dichloral urea at both rates, and N-1-naphthyl phthalamic acid gave 85 to 90 percent reductions in crabgrass counts made June 15. TCA at 2 lbs. gave a 65 percent reduction. IPC at both rates and maleic hydrazide did not significantly reduce the

number of crabgrass plants present. Weeds were removed from all plots on June 15 and a second count made July 6. Dichloral urea at both rates and N-1-naphthyl phthalamic acid gave 65 to 75 percent reductions in the number of crabgrass plants that emerged between June 15 and July 6. The other treatments did not give counts significantly lower than the check. TCA and dichloral urea caused severe distortion of the sweet potato leaves, the injury being most severe at the higher rates of application. The plants resumed normal growth after six to ten weeks. Maleic hydrazide stopped growth of the sweet potatoes completely for about three months. N-1-naphthyl phthalamic acid caused slight formative effects from which the plants recovered quickly. IPC had no visible effect on the foliage. The yield of No. 1 sweet potatoes was significantly reduced by TCA at 4 lbs., dichloral urea at 12 lbs., and maleic hydrazide. N-1-naphthyl phthalamic acid at 2 lbs. per acre was the most promising treatment included in this experiment for control of crabgrass in sweet potatoes. (Department of Horticulture, Purdue University, Agricultural Experiment Station, Lafayette, Ind.)

Effect of Sodium TCA and DNOSBP on downy brome grass (Bromus tectorum) in established alfalfa. Watson, A. J. In November, 1949, triplicated plots of established alfalfa infested with downy brome and quackgrass were treated with several rates of Sodium TCA and with DNOSBP in Dow General. The downy brome was 2 to 3 inches tall, while the quackgrass was 6 to 8 inches. The plot area was located on well drained sandy loam soil. Rates of TCA included 10, 20, 30, 40, 50, 75, and 100 lbs. acid equivalent per acre while Dow General, containing 5 pounds DNOSBP per gal., was applied as an oil-in-water emulsion at rates per acre of 1 pint plus 15 gal. fuel oil, 2 pints plus 15 gal. fuel oil, 3 pints plus 15 gal. fuel oil, 2 pints plus 10 gal. fuel oil, and 2 pints plus 20 gal. fuel oil each made up to 100 gal. with water. Both TCA and DNOSBP treatments were applied at the rate of 100 gal. of spray per acre. All rates of TCA used completely eliminated the downy brome but none resulted in permanent control of the quackgrass. None of the DNOSBP treatments controlled either grass, although in previous experiments downy brome had been eradicated when sprayed in the seedling stage with these amounts of toxicant but sprayed at 214 gal. per acre which resulted in more thorough wetting. The only apparent alfalfa injury was a slight stunting of growth in the early spring of 1950 where TCA at 75 or 100 pounds per acre had been applied, and this stunting effect was not apparent by cutting time. (Contribution from The Dow Chemical Company, South Haven, Michigan.)

PROJECT II CONTROL OF ANNUAL, WINTER ANNUAL AND BIENNIAL WEEDS

Investigation Leader:- G. Knowles

SUMMARY

After reviewing the abstracts submitted on the control of annual, winter annual and biennial weeds, the following are the main conclusion:

1. Very few failures to control these weeds have been reported.

2. A large proportion of the abstracts tell of results obtained from pre-emergence applications. These are submitted mostly by men interested in weed control in horticultural crops.

3. Numerous herbicides, too many to enumerate in this summary, have been tried as pre-emergence treatments. There appears to be outstanding differences in the effectiveness of these chemicals. This is evident in a table submitted by The Department of Horticulture, University of Illinois, which shows the results obtained on a number of different weeds from five different herbicides applied at different rates before emergence.

4. Moisture has a major influence on the results obtained from both pre and post emergence treatments. In post emergence applications it appears to have a greater influence on results than stage of growth. An example of this appears in the abstract submitted by the Bureau of Plant Industry, Soils and Agricultural Engineering, Hays, Kansas.
The influence of moisture is frequently mentioned in conjunction with pre-emergence applications. "Moisture appeared to be the most important weather factor in the percentage of weed control obtained from pre-emergence treatments". This is a quotation from the abstract submitted by The Illinois Agricultural Experimental Station.

5. Temperatures at the time of application and for a few days before and thereafter have an important bearing on the results in so far as pre-emergence weed control is concerned. Herbicides differ in their temperature requirements for optimum results.

6. There is much evidence in the accompanying abstracts to show that purslane -- which is detested by gardeners -- can be effectively controlled.

CLASSIFICATION

It would be most desirable if a means could be devised of classifying annual, winter annual and biennial weeds, with respect to their response to different amounts of various herbicides, similar in form to that which has been used for classifying perennial weeds and woody plants, but the task is complicated if one tries to include pre-emergence treatments, with all the chemicals it involves, yet it is another way of controlling these weeds.

The classification which has been initiated this year deals only with the effect of post emergence treatment of 2,4-D on annuals, winter annuals and biennials.

Often it was difficult from the data obtained to know in which class the weed should be placed consequently, the list included in this classification is rather brief.

ABSTRACTS OF RESULTS OF CO-OPERATORS

Growth of purslane, Portulaca oleracea, following treatment with 2,4-D 2,4,5-T and MCP. Buchholtz, K.P. A nearly pure stand of purslane was treated with the isopropyl esters of 2,4-D, 2,4,5-T and MCP at the rates of 0.125, 0.25 and 0.50 lbs. per acre. Application were made on July 8, 1950 when the purslane plants had stems about 2 inches long using 40 gallons of spray per acre. Four replicates were used. Plots were harvested on August 3 and fresh weights of purslane were recorded from a 2 sq. ft. quadrat in each treatment. Check plots produced an average of 55 gms. of fresh purslane tissue per sq. foot. All treated plots produced significantly less fresh weight than check but MCP was most effective in reducing purslane growth, followed by 2,4,5-T and 2,4-D. The average yields as per cent of check were 8, 25 and 43 per cent respectively for MCP, 2,4,5-T and 2,4-D. The 0.25 lb. per acre application of MCP, 2,4,5-T and 2,4-D reduced purslane weights to 5, 20 and 30 per cent of check, respectively. It appears that MCP is considerably more effective in reducing the growth of purslane than either 2,4-D or 2,4,5-T when applications are made to immature top growth. Department of Agronomy, University of Wisconsin, Madison, Wisconsin.

Growth of purslane, Portulaca oleracea, following treatment with three preparations of 2,4-D. Buchholtz, K.P. Plots in a nearly pure stand of purslane were treated with sodium salt, amine salt and isopropyl ester preparations of 2,4-D using rates of 0.125, 0.25, and 0.5 lbs. per acre. Applications were made on July 8, 1950 when the purslane plants had stems about 2 inches in length using 40 gallons of spray per acre. Four replicates were used. Plots were harvested on August 3 with the fresh weight of purslane tissue from a 2 sq. ft. quadrat being recorded. Check plots produced 68 gms. of fresh tissue per sq. foot. The average yield of purslane from plots treated with the sodium salt, amine salt and ester preparations did not differ significantly being 49, 39 and 32 per cent of check, respectively. Yields from plots treated at the 0.125, 0.25 and 0.5 lb. rates differed significantly and averaged 63, 39 and 18 per cent of check. At the 0.5 lb. rate the ester and amine preparations were significantly better than the sodium salt for yields of these treatments were 11, 15 and 27 per cent of check. Department of Agronomy, University of Wisconsin, Madison, Wisconsin.

The selective control of wild buckwheat in spring grain by 2,4-D. Carder, A.C. The triethanolamine salt and the butyl ester of 2,4-D were applied to a moderate infestation of wild buckwheat (Polygonum Convolvulus) in Regent wheat at nil, 2, 4, 6, 8 and 10 ounces acid per acre. Treatments were made (1) when the weed was in the seedling stage or had 3-4 true leaves and the wheat was in the 2-leafed stage or 3-4 inches high, and (2) when the weed was in early bud and the wheat bore heads emerging from the sheath. Inspection one month after each treatment indicated that with the early application 6 or more ounces per acre of the amine and 4 or more of the ester removed over 70 per cent of the wild buckwheat and rendered the surviving plants impotent. When the weed was treated in early bud 10 ounces of the amine and of the ester effected only 18 and 23 per cent elimination, respectively. (Contribution of Dominion Experimental Station, Beaverlodge, Alberta.)

Effect of 2,4-D on Russian thistle. Coupland, R.T. and J.F. Alex. Wheat plots infested with a heavy stand of Salsola pestifer were treated with 2,4-D amine (a mixture - Naugatuck) and butyl ester at 4, 8, 12, 16 and 32 oz. of acid per acre in three stages of development. Stage 1, June 14 when the weed was 1 to 2 inches high (wheat in 4-leaf stage); stage 2, June 28 when weed was 2 to 3 inches high (wheat in shot-blade); stage 3, July 6, weed 5 inches high in early flower (wheat in flower). A hand-powered wheel sprayer delivering 7.1 gallons per acre was used. The effectiveness of the first treatment was somewhat reduced by a low supply of soil moisture; soil moisture was plentiful at the other dates. At harvest the height of Salsola in untreated checks was 17 inches and wheat was 25 inches. Treatment reduced the height of Salsola in proportion to rate of treatment in each stage. Ester reduced height more than amine. The heights at harvest in plots treated with 4 and 32 oz. of amine in stage 1 was 14 and 4 inches, respectively; in stage 2, 8 and 2 inches; stage 3, 12 and 4 inches. Ester at 4 and 32 oz. reduced height to 12 and 4 inches, respectively, in stage 1, 4 and 1 inch in stage 2, and 8 and 3 inches in stage 3. Reduction in stand of weeds was greatest in stage 2 and with ester, increasing with the rate of treatment. Amine at 4 and 32 oz. reduced stand by harvest by 52 and 98% respectively, in stage 1, 79 and 99% in stage 2, and 61 and 96% in stage 3. Ester at 4 and 32 oz. per acre reduced stand of Salsola by 76 and 99%, respectively, in stage 1, 95 and 99% in stage 2, and 78 and 99% in stage 3. No apparent increase in yield of wheat resulted from reduction of stand and vigor of Salsola in 1949 or 1950 at Saskatoon or else any increase was counteracted by effect of herbicide. (Contribution of the Department of Plant Ecology, University of Saskatchewan, Saskatoon).

Effect of herbicides on Chenopodium album and Axyris amaranthoides. Alex, J.F. and R.T. Coupland. An alfalfa seed field at Nipawin, Sask. was treated with several herbicides at two stages. Stage 1, May 26 when the height of Chenopodium and Axyris was 1 to 2 inches; stage 2, June 24 when Chenopodium was 4 inches and Axyris was 3 to 6 inches in height. Comparison of the relative susceptibilities of these weeds was not possible because of the relatively low abundance of Chenopodium. 2,4-D and methoxone were applied by a hand-powered sprayer delivering 7.1 gallons of solution per acre. 41.5% monosodium cyanamide x 5, potassium cyanate and the dinitros (used only in second treatment) were applied by a knapsack sprayer at 74 or 100 gallons per acre. In the first stage 2,4-D butyl ester and 2,4-D amine (a mixture) both at 2 to 12 oz. per acre, methoxone n-butyl ester at 2 oz., methoxone sodium salt at 3, 6, and 15 oz., monosodium cyanamide at 50, 100 and 150 pounds and potassium cyanate at 15 and 30 pounds per acre caused 0 to 25% reduction in stand of weeds compared with checks in September; methoxone n-butyl ester at 4 and 6 oz. and methoxone sodium salt at 9 oz. caused a 25 to 50% reduction in stand; methoxone n-butyl ester at 8 and 10 oz. and methoxone sodium salt at 12 oz. resulted in a 75 to 100% destruction of weeds. In the second stage monosodium cyanamide at 50, 100 and 150 pounds, potassium cyanate at 15 and 30 pounds, sodium dinitro ortho cresylate 30% (Sinox) at 2, 4, and 8 qts. per acre and ammonium dinitro-sec-butyl phenate 13.7% (Dow Selective) at 2.2 qts. resulted in 0 to 25% reduction in stand of weeds; 2,4-D amine at 2 oz. caused 25 to 50% reduction: Dow Selective at 4.4 qts., methoxone sodium salt at 3 oz. and 2,4-D amine at 3 oz. caused 50 to 75% reduction in weed population; Dow Selective at 6.6 qts. per acre, methoxone sodium salt at 6 to 15 oz., methoxone n-butyl ester at 2 to 10 oz., and 2,4-D amine at 4 and 5 oz. per acre caused 75 to 100% destruction of weeds present. (Contribution of the Department of Plant Ecology, University of Saskatchewan, Saskatoon.)

Effect of 2,4-D on annual weeds. Friesen H.A. The amine and ester formulations of 2,4-D were sprayed at five rates, viz: 1/8, ¼, 3/8, ½ and ¾ pounds of acid equivalent per acre, on Rescue wheat infested with annual weeds. The treatments were made at three stages of weed growth, namely: (1) seedling, (2) pre bud and (3) full bloom. The weed infestation was light: Russian thistle S. kali, the predominant species had only some 24 plants per square yard; stinkweed T. arvense and wild buckwheat P. convolvulus each had some 9 plants, and lamb's quarters C. album had only some 3 plants per square yard. Growing conditions were very poor at stage 1, fair at stage 2 and excellent at stage 3.

At stage 1, at least 3/8 pound of ester or ½ pound of amine were required to give satisfactory control of Russian thistle. The ¼ and 1/8 pound rates resulted in stunting and retardation but the thistle resumed growth some 4 weeks after treatment. Stinkweed and lamb's quarters were killed completely at each rate of treatment. Buckwheat was retarded in growth for some 3 weeks but was not killed by the 3 heaviest rates of each formulation.

At stage 2, complete killing of stinkweed and lamb's quarters resulted from each rate. Similar kills of Russian thistle resulted from each rate except the ester at 1/8 pound and the amine at 1/8 and ¼ pound per acre. Good control, (the plants were stunted and made little further growth) but no kills of wild buckwheat resulted from the ester and amine at all but the 1/8 pound rate.

At stage 3, fair to good control of stinkweed, lamb's quarters, Russian thistle and buckwheat was observed only following the amine and ester at the ½ and ¾ pound per acre rates.

Yield increases large enough to be significant were not obtained at stages 1 or 2, due chiefly to the light weed infestation. At stage 3, the two heaviest rates of both amine and ester significantly depressed the yield. (Contributed by the Dominion Experimental Station, Scott, Sask.)

The effect of ME 3003 when applied as a pre-emergence treatment for the control of Purslane (Portulaca oleracea). Holm, L.G. The effectiveness of ME 3003 (disodium 3, 6 endoxohexahydrophthalate) in the control of purslane became evident when an abandoned lima bean weed control experiment was left untouched for a period of about six weeks after the chemicals were applied. The lima beans were planted on June 12 on a Miami silt loam soil with a very low organic matter content. The pre-emergence chemical sprays were applied on June 15. Hard rains prevented emergence of the crop by packing the soil. The tightly-packed soil and favorable weather which followed were conducive to the production of a stand of weeds which were almost 100% purslane. On July 28 the plots (2' x 12') which had been sprayed with ME 3003 at the rate of 8 pounds of active ingredient per acre were free of the weed while at the borders of the sprayed areas the purslane was 4" to 8" high. At 4 pounds to the acre about 3 or 4 purslane plants appeared in each plot. The experiment contained three replicates. The rainfall during the first week following planting amounted to 3.11 inches, while the precipitation up to the time of observation totalled 16.26 inches. (Contrib. of the Dept. of Horticulture, University of Wisconsin, Agricultural Experiment Station, Madison, Wis.)

The effect of 2,4-dichlorophenoxyacetic acid formulations sprayed on Annual weeds in crop at 3 rates and 2 stages of growth. Leggett, H.W. The following formulations of 2,4-D were used: (1) Triethanolamine, (2) Isopropylamine, (3) Ethyl Ester and (4) Butyl Ester. The rates used were 2, 4 and 6 oz. acid equivalent per acre. The plots were sprayed at (1) Seedling stage and (2) Flowering stage. The average percentage and types of weeds in the plots were as follows: Stage 1: Lambs Quarters Pigweed (Chenopodium album) 80%; Stinkweed (Thalpsi arvense) 10%; Blue Bur (Lappula echinata) 3%; Ball Mustard (Neslia paniculata) 4%; Hemp Nettle (Galeopsis tetrahit) 1%; Wild Buckwheat (Polygonum convolulus) 2%. Stage 2: Lambs Quarters Pigweed 70%; Stinkweed 20%; Blue Bur 3%; Ball Mustard 5%; Hemp Nettle 1%; Wild Buckwheat 1%. In the seedling stage of growth excellent results were obtained from all rates and with all formulations. The average per cent kill ranged from 96.0 to 99.8%. Growing conditions at time of spraying were excellent. In stage 2, the flowering stage, the average per cent kill ranged from 73.1 to 99.4%. Both amine formulations gave excellent kills at all rates. The ester formulations, for some reason unexplainable, gave percentage kills much lower than the amine formulations at rates of 2 & 4 oz. of acid per acre. In stage 1 (seedling stage) Hemp Nettle was stunted but continued to grow and produce seed. Wild Buckwheat in this stage was severely damaged and did not produce seed at the 6 oz. rate in all formulations. In stage 2 Hemp Nettle and Wild Buckwheat were not damaged with any of the formulations or rates. Contribution of the Dominion Experimental Station, Lacombe, Alberta.

Effect of three formulations of 2,4-D on a mixed stand of annual weeds. Phillips, W.H. Amine, isopropyl ester, and butoxy ethanol ester formulations of 2,4-D were applied at 0, 1/8, 1/4, 1/2 and 1 pound per acre on a mixed stand of annual weeds. The predominating weeds present were rough pigweed; prostrate pigweed, Kochia and puncture vine. Applications were made on two dates, June 23, 1950 and July 13, 1950. The first application was made when the soil was dry and the weeds were showing signs of lack of moisture. At the time of the second application the weeds were growing rapidly, but were larger than those treated in June. All formulations were more effective at the lower rates when applied in July than when treatments were made in June. Both esters gave more satisfactory control at lower rates than the amine, and the butoxy ethanol ester gave a higher percentage kill than the isopropyl ester. Average per cent control of all plots treated with amine was 32 per cent, isopropyl ester 45 per cent and butoxy ethanol ester 61 per cent. No difference was noted in the susceptibility of the different species to the three formulations. (Contributed by Division of Weed Investigations, Bureau of Plant Industry, Soils and Agricultural Engineering, USDA, Hays, Kansas)

Control of weeds in railroad roadbeds. Sylwester, E.P. and Hoffman, O.L. Comparative tests to control all weeds in the railroad roadbed were made during the summer of 1950. The tests encompassed the area between the rails and extending beyond the ties to the extent of 8 1/3 feet from the center of the ties, making square rod treatments. Square rod plots involving the following chemicals and rates of application were made June 23, 1950 at two different locations on railroad tracks near Ames. (1) 1 pint Santophen-20 in ½ gallon kerosene per square rod. (2) 1 pint Santophen-20 in ½ gallon kerosene per square rod plus 2 pounds 2,4-D per acre. (3) ½ pound amine 2,4-D per square rod. (4) 25 pounds TCA plus 2 pounds 2,4-D amine per acre. (5) ½ pound TCA per square rod. (6) 1 pound TCA per square rod. (7) 4 pounds 2,4-D per acre. (8) 13 pounds borax per square rod. (9) 10 pounds Anhydrous Rasorite per square rod. (10) 6 pounds Anhydrous Rasorite per square rod. (11) 1 pound sodium chlorate per square rod in 1 gallon of water. (12) 1 pound Ammate per square rod in 1 gallon water. (13) 6 pounds polybor chlorate in 3 gallons water per square rod. (14) 16 pounds polybor in 8 gallons water per

square rod. Differences were noted where the ballast was primarily cinder and where it was primarily clay and dirt. Briefly, the best results were obtained with treatments 11, 12, 6, 5, 4, and 14. Observations will be continued next year as to possible carryover of chemical action. (Contributed by Iowa State College).

Average per cent weed control obtained from various pre-emergence treatments on field plots. Taylor, Clifford E. Weed control obtained with any pre-emergence herbicidal treatment is influenced considerably by both environment and kinds of weeds. Weeds on our vegetable experimental plots have averaged 88% purslane (Portulaca oleracea), 7% pigweeds (Amaranthus sps.) and some lambsquarters (Chenopodium album), smartweeds (Rumex sps.), annual grasses and others. In a total of 233 plots given various pre-emergence herbicidal treatments the treatments (per acre basis) and average per cent weed control were as follows: Na-2,4-D at ¼ lb. - 28%, ½ lb. - 58%, 1 lb. - 70%, 1½ lbs. - 74%, 2 lbs. - 77% and 4 lbs. - 82%, Na-PCP at 15 lbs. - 78%, 20 lbs. - 81% and 25 lbs. - 84%, NH_4-DNOSBP at 5 lbs. - 74%, 6½ lbs. - 91% and 8 lbs. - 83%, xanthogen disulfide at 5 lbs. - 30% and 10 lbs. - 47%, and Stoddard solvent at 50 gals. fortified with PCP at 5 lbs. - 58%. Control of purslane: Na-2,4-D at ½ lb. - 66%, 1 lb. - 58%, 1½ lbs. 84% and 2 lbs. - 82%, Na-PCP at 15 lbs. - 73%, 20 lbs. - 69% and 25 lbs. - 85%, NH_4-DNOSBP at 5 lbs. - 84%, 6½ lbs. - 91% and 8 lbs. - 87%, xanthogen disulfide at 5 lbs. - 58% and 10 lbs. - 36% and Stoddard solvent at 50 gals. plus PCP at 5 lbs. - 40%. Control of pigweeds: Na-2,4-D at ½ lb. - 55%, 1 lb. - 79%, 1½ lbs. - 79%, 2 lbs. - 96% and 4 lbs. - 100%, Na-PCP at 15 lbs. - 98%, 20 lbs. - 100% and 25 lbs. - 98%, NH_4-DNOSBP at 5 lbs. - 52%, 6½ lbs. - 77% and 8 lbs. - 82%, xanthogen disulfide at 10 lbs. - 45% and Stoddard solvent at 50 gals. plus PCP at 5 lbs. - 85%. Control of lambsquarters: Na-2,4-D at ½ lb. - 77%, 1 lb. - 76% and 1½ lbs. - 92%. Control of smartweeds: Na-2,4-D at ½ lb. - 16%, 1 lb. - 50% and 1½ lbs. - 51%. Contribution of the Illinois Agricultural Experiment Station, Urbana, Illinois.

The effect of 2,4-D and 2,4,5-T on wild buckwheat and lambsquarter. Woestemeyer, V.W. Wild buckwheat and lambsquarter were sprayed on May 2 and May 20 with 1/4, 1/3 and 1/2 pound 2,4-D as amine and ester. On May 2 buckwheat had from 1 to 3 true leaves and lambsquarter was 4 inches high. On May 20 buckwheat was 6-10 inches high and beginning to vine and lambsquarter was 6-8 inches high. Soil was dry to 8 inches depth on May 2 but a one inch rain fell two days before the second stage. All plots in the first series were affected and indicated good control until after the rain on May 18 when they all began to recover. By wheat harvest the 1/2 pound ester showed satisfactory control of buckwheat and 1/2 pound amine and 1/3 pound ester were fair. Plots treated May 20 were retarded and showed good control of buckwheat at 1/3 and 1/2 pound ester and satisfactory control at 1/2 pound amine at harvest. The lambsquarter was controlled May 2 with 1/2 pound amine and all ester treatments. By May 20, 1/3 and 1/2 pound ester gave good control. Other rates were unsatisfactory. On May 3 in addition to the treatments mentioned above, one plot was sprayed with 2,4,5-T ester at 1/3 pound and another with a ten-day-old solution of 1/3 pound 2,4-D ester. The latter had separated some and was shaken in a jar before spraying. Results with the 2,4-D were similar to the 1/3 pound rate applied May 2 and the 2,4,5-T was slightly less effective. (Contribution of Kansas Agricultural Experiment Station.

Average per cent weed control obtained from various pre-emergence treatments on field plots. Taylor, Clifford, E. Department of Horticulture, University of Illinois, Urbana, Illinois.

Treatment	Rate/acre	No. of field plots on which used	AVERAGE PER CENT WEED CONTROL				
			Total Weeds	Purslane	Pigweeds	Lambs-quarters	Smart-weeds
Na-2,4-D	1/4 lb.	6	28%	--%	--%	--%	--%
"	1/2 lb.	36	55	66	55	77	16
"	1 lb.	33	70	58	79	76	50
"	1½ lbs.	18	74	84	79	92	51
"	2 lbs.	15	77	82	96	--	--
"	4 lbs.	9	82	--	100	--	--
Na-PCP	15 lbs.	6	78%	73%	98%	--	--
"	20 lbs.	18	81%	69	100	--	--
"	25 lbs.	6	84	85	98	--	--
NH_4-DNOSBP	5 lbs.	12	74%	84%	52%	--	--
"	6½ lbs.	12	91	91	77	--	--
"	8 lbs.	16	83	87	82	--	--
Xanthogen disulfide	5 lbs.	9	30%	58%	--%	--	--
" "	10 lbs.	21	47	36	45	--	--
Stoddard solvent at 50 gals. plus PCP at	5 lbs.	16	58%	40%	85%	--	--

The overall average on the weeds were 88% purslane (Portulaca oleracea). 7% pigweeds (Amaranthus sps.), and some lambsquarters (Chenopodium album), smartweeds (Rumex sps.), annual grasses and others.

The effect of 2,4-D on treacle mustard, false flax and coreopsis. Woestemeyer, V.W. Treacle mustard, false flax and coreopsis were sprayed with 1/4, 1/3 and 1/2 pounds 2,4-D as amine and ester May 2, when mustard was in bloom and flax and coreopsis were five to seven inches high. Wheat, in which these weeds are a problem, was forming the second joint. Soil was dry and plants were not growing vigorously. The coreopsis was somewhat resistant at this time and 1/2 pound ester killed the plants while 1/3 pound ester retarded growth but some plants matured. False flax and coreopsis were affected slightly at the lowest rates of amine, but 1/2 pound amine and 1/3 pound ester were necessary for satisfactory control. 1/2 pound ester was necessary to kill the weeds. (Contribution of Kansas Agricultural Experiment Station.)

PROJECT II CONTROL OF ANNUAL, WINTER ANNUAL AND BIENNIAL WEEDS

Classification of above weeds. Investigation Leader:- G. Knowles

Basis of Classification

I. (Very sensitive)	Any weed killed at indicated stages of growth with 4 ozs. or less of 2,4-D.
II. (Sensitive)	Any weed killed at indicated stage of growth with 5 to 8 ozs. of 2,4-D.
III. (Semi-tolerant)	Any weed severely affected but not killed at indicated stages of growth with from 5 to 8 ozs. of 2,4-D.
IV. (Tolerant)	Any weed not affected to any extent at indicated stages of growth with from 5 to 8 ozs. of 2,4-D.

USE OF ROMAN NUMERALS:

For the sake of brevity the above Roman numerals are used in the accompanying tables to indicate the reaction of each weed at the stage when the treatment was applied. e.g. (I) Very sensitive, (II) Sensitive, (III) Semi-tolerant, (IV) Tolerant.

ABBREVIATIONS: A - Amine; E - Ester; T- 2,4,5-T

CLASSIFICATION OF ANNUAL, WINTER ANNUAL AND BIENNIAL WEEDS

COMMON NAME	SCIENTIFIC NAME	FORMULATION USED	STATE OR PROVINCE	SEEDLING GROWTH	SHOOTING	BUD	BLOOM
Cinquefoil	Potentilla sp.	A.	Ohio	I	I	I	II
Catchfly, Night-flowering	Silene noctiflora	A.	Ohio	III	III	III	IV
Carpet weed	Molluga venticillate	E.	Kansas				IV
Cut leaved primrose	Enothera laciniata	E.	Kansas	I	I		
Lambs quarters	Chenopodium album	A.	Ohio	I	II	II	II
Lambs quarters	Chenopodium album	E.	Kansas	I	II		
Lambs quarters	Chenopodium album	A.	Kansas	II	II		
Mustard, wild	Brassica arvensis	A.	Ohio	I	I	I	I
Night shade, black	Solanum nigrum	A.	Ohio	III	III	III	IV
Pigweed, rough	Amaranthus retroflexus	A.	Ohio	II	II	II	III
Plantain, buckhorn	Plantago	A.	Ohio	I	III		
Purslane	Portulaca	E.	Kansas				IV
Ragweed, common	Ambrosia artimisiifolia	E.	Kansas	II	III	III	III
Smartweed	Polygonum persicaria	E.	Kansas		III	III	III
Velvet weed	Albutilon theophrasti	E.	Kansas	I	II	III	III
Wild buckwheat	Polygonum Convolsulus	E. & A.	Kansas				IV
White prickly poppy	Angemone intermedia	E.	Kansas		II		
Yellow foxtail	Setaria glauca	A.	Ohio	II	IV		

Project III. Control of Weeds in Field Crops.

Spring Sown Grain — E. A. Helgeson

Summary

Barley: A considerable number of cooperators reported spraying various barley varieties with the sodium salt, ester and amine formulations of 2, 4-D at intervals of 3 or 4 days beginning with a pre-emergence spray. Usually rates were from 2 to 8 oz. acid equivalent per acre. Since only a few contributions made any reference to stage of plant development comparisons are difficult to make. As nearly as the writer could determine yields were reduced when barley was sprayed as floral primordia were forming and at or mear anthesis. Other workers reported reduced yields from sprays in the 3 leaf, late foot, flowering, early milk, and fully headed stages. Abnormal heads, leaves and growth were recorded by a number of workers from sprays in the earlier growth stages. Derscheid reported that seeds from abnormal plants originally grown in 1948 failed to show signs of abnormality or reduced yields in 1949 or 1950. In a number of instances ester formulations proved most detrimental followed by amine and salt. Using 7 formulations of 2, 4-D at 2 oz. per acre on 20 day barley, Parlychenko noted a trend towards higher dry matter production in relation to weeds in barley, wheat and oats. Increases in yield were also reported for ACP 648 with barley and a reduction of yield for other formulations. Somewhat similar results were obtained with similar chemicals applied at 31 days with 2, 4-D acetanilide and amine reducing yields.

Oats: Contributors placed considerable emphasis upon spraying at frequent intervals from pre-emergence through heading. Generally, pre-emergence and the fully tillered stage showed the least effect at rates up to 1/2 lb. of 2, 4-D. There were notable exceptions at this stage in a number of instances. Seedling, jointing and boot stages appear to be the most generally cited sensitive stages. Mindo, Clinton, Terain, Vangard and Exeter seemed to be somewhat more sensitive to 2, 4-D than several other varities. Reports on germination from seed grown on treated plots were inconclusive, while evidence for a carry over of abnormalities is lacking. MCP was found to be slightly less toxic than 2, 4-D by several workers. Rates above 1/2 lb., particularly ester and amine, are especially toxic to oats. Pavlychenko reported decreased weed growth and increased yields from some esters and amines applied at 2 oz. per acre on plants 20 and 31 days after emergence.

Wheat: Results of past seasons work were generally confirmed by abstracts submitted. There was little conclusive evidence for varietal differences although no extensive trials were reported on this phase. Several workers reported plant abnormalities on plants sprayed at various stages from emergence to full tillering, but that such deformities did not always result in reduced yields. As in the past the fully tillered stage stood out as the most resistant period with the boot, seedling and flower stages being most sensitive. Agreement was not unamous on these latter stages, since some abstracts showed little or no detrimental effect here. Results on rates varied, in one instance, treatments up to 32 oz. of ester caused no reduction in yield except at the flower stage where other workers reported 8 oz. of amine as being detrimental in seedling and boot stages. One report showed dusts as being less effective than sprays in mustard control and 2, 4, 5-T as less toxic than comparable rates of 2, 4-D. One report on protein as affected by sprays indicated the period from early shotblade to seed setting yielded an increase of .5% or more with increases up to nearly 2% from sprays at

the time of head formation. One report on wheat indicated reduced weed growth and increased yields from 5 formulations of 2, 4-D applied at 2 oz. per acre when plants were 20 and 31 days old. Weedone was the most effective at 20 days and ACP 649 at 31 days.

Buckwheat and proso millet: See abstract by Dunham et al.

Abstracts from Cooperators

2, 4-D on Clinton 59 oats. Bernard, R. L., and Willard, C. J. Oats sowed April 18. Miami-Brookston soils. Plots 6' x 24', triplicated, isopropyl ester of 2, 4-D applied at 0, 1/4, 1/2, 1, 2, and 4 pounds acid equivalent per acre, pre-emergence April 21, and 8 post-emergence dates, 1 week apart, May 7 to June 26. Weeds were not a factor in the results, Pre-emergence caused some loss, significant at 4 poinds per acre. All rates caused signigicant losses in yield at the boot stage, the jointing stage and the two-leaf stage. 1/4 pound and 1/2 pound caused no significant yield reductions at any other stages. Rates over 1/2 pound caused losses in yield except at bloom and after. The least injurious stages were bloom, milk and fully tillered. Oats were more injured than wheat at the latter stage. The results checked very well with last year's test, which used the same variety. (Res. Rept. NCWCC, 1949, page 111c.) (Contribution of the Ohio Agricultural Experiment Station.)

The effect of 2, 4-D on barley at different growth stages. Carder, A. C. Weed-free Olli barley was treated with the triethanolamine salt and the butyl ester of 2, 4-D at 4 and 8 ounces acid per acre. Treatments were made at 16 stages of crop growth beginning 2 days prior to emergence and ending at the hard dough stage. A 3-day interval between treatments was attempted although this schedule had to be modified somewhat. The greatest interval was 6 days, occurring while the barley was heading. Shortly after the last treatment with barley still in the dough, 5 inches of snow fell followed by 5 degrees of frost. Snow obscured the effects of 2, 4-D on straw strength, while frost largely masked differences in maturation and yield. Second growth induced by July rains and June drought added complications. Olli barley seems to possess considerable tolerance towards 2, 4-D; proliferation, fasciation, and blasting of the kernel was rare and these abnormalities could not be correlated with specific treatments. Yield data suggest that no injury resulted from the pre-emergence treatment. Curtailment of yield occurred with all rates and formulations when applied at time of emergence. From emergence to shot blade and from early head to almost full head 2, 4-D seemed to have depressed yields little. Yield was reduced when the chemical was applied later than this stage produced no yield response. (Contribution of Dominion Experimental Station, Beaverlodge, Alberta.)

Effect of 2, 4-D on wheat. Coupland, R. T. and J. F. Alex. 2, 4-D amine (a mixture - Naugatuck) and butyl ester were applied at 0, 4, 8, 12, 16 and 32 oz. of acid per acre to quadruplicated plots of Thatcher wheat in three stages of development. Stage 1, June 14 when it was in the 4-leaf stage and 5 to 6 inches high; stage 2, June 28, in shot-blade at 10-14 inches high; stage 3, July 6, emasculating at 20-24 inches high. All plots were infested with Salsola pestifer. Reduction of stand of weed was 80 to 100% in all cases except with amine at 4 oz. in stages 1 and 3. Vigor of Salsola was also reduced greatly. No apparent correlation existed between reduction in stand of weed and yield of wheat. Effect of 2, 4-D in stages 1 and 2 was small, the 32 oz. plots averaging 3% below the weed infested checks. Treatment with amine in the third stage (flower) resulted in 2, 11, 15, 21 and 28% reduction in yield (below untreated, weed-infested checks),

respectively, with 4, 8, 12, 16 and 32 oz. per acre. The same rates of ester caused 11, 28, 27, 17 and 32% reductions in yield, respectively. Height of wheat was not affected except temporarily by 32 oz. of ester. Supply of soil moisture was low in stage 1 and good in stages 2 and 3. (Contribution of the Department of Plant Ecology, University of Saskatchewan, Saskatoon).

Physiological response of barley when treated with 2, 4-D at nine stages of growth. Derscheid, Lyle A. Triplicate, 4-row plots, 14' long, of an early variety; Plains, and a late variety; Wisconsin #38, in 1949 and Moore in 1950, were treated with the butyl ester of 2, 4-D at the rate of one pound of acid equivalent per acre at Brookings, South Dakota in 1949 and at Ames, Iowa in 1950. Treatments were made at 3-day intervals. The first 1949 treatment was made when both varieties had five leaves and the last treatment was made when Plains was starting to head but before Wisconsin #38 had started to head. The first 1950 treatment was applied when both varieties had 4 leaves and Plains had one tiller while the last application was made when awns of Plains were emerging from the boot and Moore had started to joint. In 1950 the yield of Plains was reduced approximately 10 bu/A by each of the first five treatments, which were applied when floral primordia were being laid down by either the main culm or one of the tillers, and by the 7th and 8th treatments which were applied during anthesis. The yield of Moore was reduced by the first 7 treatments, which were made while floral primordia were being laid down on main culm or one of first two tillers, and again by the 9th treatment which was applied when floral primordia were laid down on third tiller and when Moore was approaching anthesis. The 1949 yields were reduced by treatments applied to Plains in anthesis and to Wisconsin #38 when floral primordia were being laid down in main culm. Floral primordia data were not obtained for the tillers in 1949, but since the yields of 1949 follow the same general trend of 1950, it is probable that the depressions came when floral primordia of tillers were being produced. (Contribution of Agronomy Department of South Dakota Agricultural Experiment Station.)

The effect of 2, 4-D application on the succeeding generation of barley at Brookings, S. Dak. Derscheid, Lyle A., D.E. Kratochvil. The yield of Spartan, Plains, Feebar, Odessa, Kindred, Manchuria and Wisconsin #38 barley treated with one pound of acid equivalent of a butyl ester of 2, 4-D at the 5-leaf stage of growth was reduced in 1948. Seed from these plots and seed from untreated plots was planted in six replications of a split plot design in 4-row plots 14 feet long in 1949. The yields of the above 7 varieties and Andrews were reduced by a similar treatment in 1949 and seed from treated and untreated plots was planted in 1950. Yield and test-weight data were obtained from the 1949 and 1950 tests and the data were analyzed statistically. A difference in yield or test-weight of these varieties due to treatment with 2, 4-D the previous year was not established. Two-hundred abnormal spikes were selected from treated plots in 1948 and seeded in head-rows in 1949. The seed from each head-row was bulked and planted in rows in 1950. Observations were made in 1949 and 1950 but none of the malformations observed on the original spike were observed either year indicating that these abnormalities are not transmitted to succeeding generations. (Contribution of the Agronomy Department of the South Dakota Agricultural Experiment Station.)

The effect of 2, 4-D on the succeeding generation of oats at Brookings, S. Dak. Derscheid, Lyle A. and D. E. Kratochvil. The yield of Brunker, Trojan, Richland, Tama, Vikota, Mindo, Clinton, Andrews, Bonda or Marion was reduced in 1949 when one pound acid equivalent of a butyl ester of 2, 4-D was applied per acre to the crop when it was in the 5-leaf stage of growth. Seed from these plots and from untreated plots was planted in 4-row plots, 14 feet long, and replicated six times

in a split plot design in 1950. Yield and test weight data were obtained and analyzed statistically. It was not established that yield or test-weight were affected by the application of 2, 4-D the previous year. (Contribution of the Agronomy Department, South Dakota Agricultural Experiment Station.)

Effect of 2, 4-D on buckwheat and proso millet. Dunham, R. S., R. G. Robinson, and O. H. Shulstad. A commercial mixture of Japanese and Silverhull buckwheat and an orange-seeded proso millet were sown with a grain drill, June 30, on clean land. Separate plots of the buckwheat were sprayed (1) on July 20 when 8 inches tall and (2) on July 31 when in full bloom and 24 inches tall with 4, 8, and 16 oz. of 2, 4-D (dimethylamine) per acre. No treatment killed the buckwheat but injury was severe for all dosages at the first stage and for 16 oz. at the second stage. Injury was much more severe in the first stage with equivalent amounts of 2, 4-D. Yields are not available at present. Dosages for the proso millet were 8 and 16 oz. per acre applied (1) July 31, when less than 8 inches tall and (2) Aug. 18, when fully headed. No practical injury resulted from any treatment. (Contribution from the Division of Agronomy and Plant Genetics, University of Minnesota, St. Paul, Minnesota, Paper No. 717, Misc. Jour. Series, Minn. Agri. Exp. Station.)

Pre-emergence treatments with barley. Foster, J. Roe. Different rates of amine and ester formulations of 2, 4-D, including two low volatile esters, and 2, 4, 5-T were applied as pre-emergence treatments to Montcalm barley. Wild mustard (Sinapis arvensis) were completely controlled by all treatments. There were no visible deformities and very little retarding of heading resulting from these treatments. A considerable increase in yield was obtained where 8 ounces of the common 2, 4-D ester was applied, but there was no sifnificant effect on yields from the other treatments. (Contributed by the Dominion Department of Agriculture, Experimental Farms Service, Dominion Experimental Sub-Station, Regina, Saskatchewan, Canada.)

Effect of 2, 4-D on barley when applied at different growth stages. Foster, J. Roe. Ester, amine, and sodium salt formulations of 2, 4-D were applied to Montcalm barley daily whenever weather conditions permitted, at rates of 2, 4, and 8 ounces of acid per acre. The first application was made before emergence, and the last 14 days after heading. The longest interval between sprayings was 4 days. The ester formulation caused a delay in heading up to 6 days when spraying was done between the 16th and 44th day after emergence, or from the 5-leaf stage to near heading. When rain fell immediately after treating there was less delay in heading. The amine and sodium salt formulations did not delay heading. Head deformities occurred with ester and amine formulations when sprayed before the 5-leaf stage. More deformities occurred with ester and amine formulations when sprayed before the 5-leaf stage. More deformities occurred in the ester treated plots than the amine, and from the heavy rates of application. No deformities were found in the plots treated with sodium salts of 2, 4-D. Due to damage from heavy August frosts, no yield data are available. (Contributed by the Dominion Department of Agriculture, Experimental Farms Service, Dominion Experimental Sub-Station, Regina, Saskatchewan, Canada.)

Effect of 2, 4-D on oats when applied at different growth stages. Foster, J. Roe. Ester, amine and sodium salt formulations of 2, 4-D were applied to Exeter oats daily whenever weather conditions permitted, at rates of 2, 4, and 8 ounces of acid per acre. The first application was made before emergence, and the last 15 days after heading. The longest interval between sprayings was 4 days. The 2, 4-D had no noticeable effect on date of heading, deformities, or amount of blast present. Due to damage from heavy August frosts, no yield data are available. (Contributed by the Dominion Department of Agriculture, Experimental Farms Service, Dominion Experimental Sub-Station, Regina, Saskatchewan, Canada.)

Effect of chemicals on oats when treated within two days after emergence. Foster, J. Roe. Different rates of ester and amine formulations of 2, 4-D, including low volatile ester forms, and 2, 4, 5-T were applied to Exeter oats within two days after emergence. All these treatments controlled wild mustard 100%. All treatments except the 2, 4, 5-T treatments resulted in longitudinal curling of the leaves, and the heavier rates of common ester 2, 4-D resulted in some burning of the leaf tips. One low volatile form of ester also resulted in burning of the leaf tips. Yields were depressed by most applications of ½ lb. or more of acid per acre. Heading was usually delayed one day by the ½ lb. rates and 2 days by the 2 lb. rates. (Contributed by the Dominion Department of Agriculture, Experimental Farms Service, Dominion Experimental Sub-Station, Regina, Saskatchewan, Canada.)

Effect of 2, 4-D on wheat when applied at different growth stages. Foster, J. Roe. Ester, amine, and sodium salt formulations of 2, 4-D were applied to Thatcher wheat daily whenever weather conditions permitted, at rates of 2, 4, and 8 ounces of acid per acre. The first application was made before emergence, and the last 19 days after heading. The longest interval between sprayings was 4 days. There was no noticeable effect on date of heading from these treatments in 1950. Head deformities occurred on the wheat sprayed between the 2nd and the 26th day after emergence, when the wheat was 9 inches tall and had 10 leaves. The most severe occurrance of deformities occurred from treatments made 8 to 19 days after emergence, when up to 96% of the heads showed deformities. The ester, amine and sodium salt formulations all had similar trends, and the higher the rate of application, the more deformities there were. Due to damage from heavy August frosts no yield data are available. (Contributed by the Dominion Department of Agriculture, Experimental Farms Service, Dominion Experimental Sub-Station, Regina, Saskatchewan, Canada.)

Effect of chemicals on wheat when treated within two days after emergence. Foster, J. Roe. Different rates of ester and amine formulations of 2, 4-D, including low volatile ester forms, and 2, 4, 5-T were applied to Thatcher wheat within two days after emergence. All these treatments controlled wild mustard (Sinapis arvensis) 100%. Yields were reduced by all treatments except those using 2, 4, 5-T and the 4-ounce rate of common 2, 4-D ester. The low volatile esters of 2, 4-D caused considerably more delay in heading than did the common type of ester. Head deformities were numerous in all but the 2, 4, 5-T treatments. (Contributed by the Dominion Department of Agriculture, Experimental Farms Service, Dominion Experimental Sub-Station, Regina, Saskatchewan, Canada.)

Dusting vs. low volume spraying with 2, 4-D on wheat. Foster, J. Roe. Sodium salt, amine, and ester formulations of 2, 4-D were applied to Thatcher wheat in dust and liquid forms at two stages of growth, namely, when the wheat was in the 3-leaf and 5-leaf stages. Rates of application were 2, 4, and 8 ounces of acid per acre. At the 3-leaf stage, 92.6% of the weeds (Sinapis arvensis) were killed with 2 ounces of ester spray and 100% were killed by the 4 and 8-ounce rates. The ester dust killed 66.6% of the weeds at the 2-ounce rate. 75% at the 4-ounce rate, and 81.6% at the 8-ounce rate. The amine and sodium salt were somewhat less effective than the esters. Increases in yield were obtained roughly in proportion to the weed control when sprayed at the 3-leaf stage. At the 5-leaf stage the weeds were not as easily controlled, but again the sprays were decidedly more effective than the dusts. Small decreases in yield were obtained when treated at the 5-leaf stage. These results for 1950 are in general agreement with the averages for the past three years. (Contributed by the Dominion Department of Agriculture, Experimental Farms Service, Dominion Experimental Sub-Station, Regina, Saskatchewan, Canada.)

Effect of 2, 4-D on spring sown barley. Friesen, H. A. The amine and ester of 2, 4-D were sprayed on Titan barley at two rates, viz: ¼ and ½ pound of acid equivalent per acre. The treatments were made at 20 stages of growth, beginning just prior to emergence and continuing at roughly 3 day intervals until the dough stage. Growing conditions were very poor i.e. cold, dry and windy until the 10th treatment stage. The plots were kept weed free by means of hoeing. At stages 1 and 2, previous to emergence, the barley was not affected by any of the treatments. During stages 3 to 10 inclusive (full emergence to the jointing or pre shot blade stage) plant deformities resulted from each treatment. The chief deformities were club-shaped heads, curly awns, abnormal leaves and severe stunting of the late tillers. At stages 6 and 7, when the plants were 4 to 6 inches long, each treatment resulted in 100 percent of the plants showing abnormalities. Significant yield reductions resulted from each treatment at these two stages; at stages 3, 4, and 5, only the ½ pound rate of amine and ester depressed the yield. Only a few plant deformities and no reduction in yield resulted from any of the treatments during stages 11, 12, 13, and 14. At stage 15, 3 days before heading, each treatment caused lodging and sterility which resulted in significant yield reductions. Some lodging occurred at stages 16 and 17, further, the ½ pound of ester reduced the yield at stage 16. Treatments at stages 18 to 20 inclusive, had no adverse effect on the barley. (Contributed by the Dominion Experimental Station, Scott, Sask.)

Effect of 2, 4-D on spring sown oats. Friesen, H. A. Amine and ester of 2, 4-D were sprayed on Ajax oats at rates of ¼ and ½ pound of acid equivalent per acre. Treatments were made at 20 stages of growth, beginning just prior to emergence and continuing at roughly 3 day intervals until the grain had passed the milk stages. Growing conditions were cold, dry and windy until the 10th treatment stage. Plots kept weed free by hoeing. At stage 1, none of the treatments affected the grain. In stages 2, 3, 4, 5, 6 and 7 (full emergence until the crop was 5 inches tall), each treatment resulted in some plant deformities, chiefly onion-like leaves. The deformities were few at the ¼ pound rate of amine and increased rapidly in frequency at the ¼ pound rate of ester, and the ½ pound rates of amine and ester respectively. The most frequent and severe deformities occurred at stages 6 and 7. Yield reductions at the ½ pound rates of amine and ester occurred at each of the stages. At stages 8 to 11, deformities were rare with no depression in yield except at the ½ pound of ester at stage 11. At stages 12 to 15 (16 to 7 days before heading), twisted stems, lodging and depressed yields resulted from both the amine and ester at the ½ pound and the ester at the ¼ pound per acre rate. Maturity was delayed by 2 days as a result of the heavy rate of ester and amine. Except for slight lodging at stage 16 and a delay of 1 day in maturity for the ½ pound rates of the ester at stages 16 and 17, none of the treatments at the remaining stages affected the oats. (Contributed by the Dominion Experimental Station, Scott, Sask.)

Effect of 2, 4-D on spring wheat. Friesen, H. A. The amine and ester of 2, 4-D were sprayed on Rescue wheat at two rates, viz: ¼ and ½ pound of acid equivalent per acre. The treatments were made at 20 stages of crop growth, beginning just prior to emergence and continuing at roughly 3 day intervals until the grain was in the dough stage. Growing conditions were very poor, i.e. cold, dry, and windy until the 10th stage or date of treatment. The plots were kept weed free by means of hoeing. At stage 1, 2 and 3, i.e. prior to full emergence, none of the 2, 4-D treatments affected the yield or agronomic characters of the wheat. During stages 4, 5, 6 and 7, (full emergence until the wheat was 3 to 4 inches long) each of the treatments resulted in a high percentage of head and leaf deformities. Further, a reduction in plant height of some 2 inches and a delay in heading of 2 to 3 days

was noted. Yield reductions occurred at each of these stages but only at the ½ pound of ester at stage 5 was the reduction statistically significant. At stages 8, 9, 10 and 11 (crop 6 inches long until very early shot blade), plant deformities were rare and the yield was not reduced. At stage 12, 16 days before heading, deformed plants were not observed but due to sterility, highly significant yield reductions resulted from each treatment. At stage 13, 13 days before heading, the yield was significantly reduced by the ½ pound rate of either amine or ester. At stages 15 and 19, some lodging resulted at each treatment. No effect on the agronomic characters or yield was observed at stages 14, 16, 17, 18 and 20. (Contributed by the Dominion Experimental Station, Scott, Sask.)

Effect of 2, 4-D on the quality of spring wheat. Friesen, H. A. In 1949, the variety Rescue was treated with 2, 4-D at 15 stages of crop growth. At each stage, the amine and ester formulations were applied at the rates of 1/4 and 3/4 pound of acid equivalent per acre, while the sodium salt was applied only at the 3/4 pound per acre rate. The plots were kept weed free by hoeing. Milling and baking quality tests were made by the Cereal Division, Ottawa, on a wheat sample from each 2, 4-D treatment at each of the 15 dates of application. On the basis of the quality tests, percentage of wheat protein was the only factor which tended to show a definite pattern of response to the 2, 4-D treatments. Treatments at stages 9 to 14 inclusive (the period from early shot blade to seed setting), generally increased the protein content of wheat by more than .5 percent. Exceptions to this were: the amine at ¼ pound per acre rate at stages 9, 12 and 13, and the sodium salt at stages 10, 11 and 14. The greatest increase in protein was noted at the approximate time when the heads had begun to form (stage 14), at which time each treatment except sodium increased the protein by almost 2 percent. It was at stages 11 and 12, that the greatest yield reductions as a result of 2, 4-D occurred in 1949. Yield reductions due to early 2, 4-D treatments at stage 3, 4 and 5 were recorded in 1949. It was of interest to note that the protein content of the samples was not increased by 2, 4-D at these stages. Generally the protein content of the samples from stages 1, 2, 6, 7 and 8 was not materially affected. (Contributed by the Dominion Experimental Station, Scott Sask.)

The effect of 2, 4-dichlorophenoxyacetic acid sprayed on Olli barley at 3 day intervals. Leggett, H. W. The plots were sprayed every 3 days from 6 until 87 days after seeding with 8 oz. of 2, 4-D acid per acre of the Butyl Ester formulation. Field observations of the sprayed plots showed that the plots sprayed 18 days after seeding produced several types of deformities, such as twin heads, fused sheaths, sterile florets, etc. Some of tillers in the other plots, sprayed later, which were in approximately the same stage as those in the plots sprayed 18 days after seeding, showed some of the same types of deformities. The barley plots sprayed 75 days after seeding weakened the straw so that the grain lodged and also appeared to delay maturity.

After analyzing the yield data there were 4 plots which were significantly lower yielding than the check plots. These were (1) 18 days after seeding, when the barley was in the 3 leaf stage, (2) 42 days after seeding, when the barley was in the very late shot-blade stage, (3) 63 days after seeding, when the barley was in the flowering stage, (4) 75 days after seeding, when the barley was in the early milk stage. All other plots, sprayed both before and after, yielded well and showed no significant differences from the checks. The above results are in line with similar experiments done in previous years.

From this experiment it would appear that barley should not be sprayed in the 3 leaf, late shot blade, flowering and early milk stages of growth, but at all other stages it may be sprayed safely with 8 oz. of 2, 4-D acid per acre or less. (Contribution of the Dominion Experimental Station, Lacombe, Alberta.)

The effect of 2, 4-Dichlorophenoxyacetic acid sprayed on Larain oats at 3 day intervals. Leggett, H. W. The plots were sprayed every 3 days from 6 until 87 days after seeding with 8 oz. of 2, 4-D acid per acre of the Butyl Ester formulation. Observations made in the field showed that the 4 plots sprayed from 24 to 33 days after seeding had a preponderounce of deformed type heads in which there were many sterile florets. This seriously affected the yield of these plots as they were significantly lower than the check plots. The plots sprayed 18 and 39 days after seeding were also significantly lower than the check plots. The plots sprayed 21 and 36 days after seeding, while not significantly less than the check, were down very close to the border line. The stage of development of the oat plants from 18 to 39 days after seeding was from the 4 leaf stage through to the early shot blade stage. This period of 21 days, according to our data, shows that it is not safe to treat oats with 8 oz. of 2, 4-D acid equivalent per acre while the plants are in the 4 leaf to early shot blade stage of growth. Treating before and after those stages, there was no significant damage to the oat yield in any of the plots. While no significance can be attached to the weight per bushel figures taken, it is worhtwhile noting that the 5 plots sprayed from 18 to 30 days after seeding were the lowest of all 30 plots. (Contribution of the Dominion Experimental Station, Lacombe, Alberta.)

The effect of 2, 4-dichlorophenoxyacetic acid sprayed on Saunders wheat at 3 day intervals. Leggett, H. W. The plots were sprayed every 3 days from 6 until 87 days after seeding with 8 oz. of 2, 4-D acid per acre of the Butyl Ester formulation. Observations made in the field showed very plainly that wheat sprayed from 21 to 33 days after seeding produced an abundance of deformed type heads. These plots could be picked out easily in all replicates. The growth stages at that time were from the 4 and 5 leaf stage to early shot-blade stage. All plots sprayed at other times did not exhibit these deformities except where there was some late tillering. From observations on these plots it appeared as if there would be some yield differences. On analyzing the yields of the plots no significant differences, over the check plots, showed up. In fact the yields of the 30 treatments were remarkably uniform. It was not anticipated that we would get as long a period as 12 days in which spraying with 2, 4-D would cause deformed heads. The treatment 27 days after seeding, when the wheat was in the tillering stage, produced the largest number of deformed heads, closely followed by the plots treated 24 days after seeding. These were followed by the plots treated the following number of days after seeding: 30, 21 and 33. The results of this experiment indicate that wheat is more tolerant to 2, 4-D than the other cereal grains and that deformities in the heads do not affect the yield significantly. These results verify work done at this station in previous years. (Contribution of the Dominion Experimental Station, Lacombe, Alberta.)

Differential response of three varieties of barley to treatment with 2, 4-D. P. J. Olson. Montcalm, O.A.C. 21 and Vantage barley were treated with alkanol amine and isopropyl ester in 1950. Each formulation was applied to two rates, namely 4 and 8 ounces acid equivalent per acre. The applications were made on two dates; the first on July 4th., when the plants were 8 inches tall (seeding date May 28th.) and the second on July 18th., when the awns were protruding from the boot. No significant differences in yield between treatments were recorded for any of the varieties. When the data for all the varieties were averaged it appeared that there was some reduction in yield under the 8 ounce rate of butyl ester applied on the second date. (Contribution from the Division of Plant Science, University of Manitoba)

Reaction of Barley to 2, 4-D when applied at different Stages of growth. Olson, P. J. and Brown, D. A. Isopropyl ester was sprayed on Montcalm barley at 8 ounces acid equivalent at Headingly, Manitoba, (near Winnipeg) and Butyl ester on Plush barley at Brandon. The first application was made a few days before emergence and was continued at approximately 3-day intervals until the crop was past heading. The experiment was a disappointment at both sites, having been seriously marred by a very ununiform stand at Headingly, and by severe lodging at Brandon. No statistically significant yield reductions took place at either site although the familiar abnormalities made their appearance at the usual stages. In 1949 at Winnipeg and Brandon and in 1948 at Winnipeg, there were two sharply defined periods when the plants were highly susceptible to damage. It is significant, in the light of this fact, that in 1950 at Headingly the lowest yields were recorded during a period corresponding closely to one of those just mentioned, namely following the 4th and 5th treatments, when the plants were 3 to 3 1/2 inches tall. At Brandon the lowest yield but one occurred under the 6th treatment, when the plants were 4 inches tall. The lowest yield at Brandon was recorded for the last treatment, when the plants had just reached full heading. Very severe lodging was associated with this treatment. (Joint contribution from the Division of Plant Science, University of Manitoba, and Dominion Experimental Farm, Brandon.)

Differential response of oat varieties to 2, 4-D. Olson, P. J. A butyl ester and an alkanol amine were applied each at 4 and 8 ounces acid equivalent per acre to each of Ajax, Exeter and Vanguard oats, on each of two dates. The first date was July 5th. when Vanguard was 8 inches, and the varieties Ajax and Exeter 10 inches tall. The second application was made when each of the varieties was showing heads beginning to protrude from the boot and was July 14th for Ajax, July 25th for Vanguard and July 29th for Exeter. The applications were in the form of water spray at 60 gallons per acre. For the first spraying date only Vanguard showed any significant reduction in yield, and this only under the 8 ounce rate of amine. For the second date only Exeter showed a significant yield reduction and this again only under the 8 ounce rate of amine. (Contribution from the Division of Plant Science, The University of Manitoba, Winnipeg.)

Reaction of wheat to 2, 4-D applied at different stages of growth. Olson, P. J. and Breakey, W. J. Butyl and isopropyl ester were applied to Redman wheat at the rate of 8 ounces acid equivalent per acre, on each of 20 dates starting shortly before emergence and continuing at approximately 3-day intervals until the crop was well past heading. The experiment was conducted at Morden and Headingly and was a continuation of one conducted at Morden and Winnipeg in 1949. (Butyl ester at Morden and isopropyl at Headingly). The results supported those of 1949 in delineating two widely separated periods during which the crop was particularly susceptible to injury. The first was represented by early seedling stages when the plants were 2 to 4 1/2 inches tall and had 2 leaves. The second occurred in the boot stage 11 to 15 days in advance of heading. At Morden the damage during the earlier or seedling stages was much more severe than in the later or boot stage; the respective yields being 25.4 and 35.0 (necessary difference 4.6 bu.). At Morden statistically significant yield reductions took place at several stages between these periods, but these were relatively small. (Joint contribution from the Division of Plant Science, University of Manitoba, and Dominion Experimental Station, Morden, Manitoba.)

Differential response of wheat varieties to 2, 4-D. Olson, P. J. and Breakey, W. J. An isopropyl ester and an alkanolamine were applied, each at 4 and 8 cunces acid equivalent per acre on two dates at Headingly, Manitoba, to Redman, Thatcher, and Stewart wheat. At Morden a butyl ester was applied at 4 and 8 ounces and an

alkanolamine at 6 and 12 ounces at one date to Redman, Thatcher, Lee and Carleton wheat. Water sprays were used. At Headingly, where the first application was made on June 30th., when the plants were 8 to 9 inches tall, Stewart showed a statistically significant yield reduction under the 8 ounce rate of ester, and Thatcher under the 4 and 8 ounce rates of amine. The averages for rates over both dates and all varieties, however, showed no significant differences between rates, which fact throws doubt upon the reality of the differential variety response. This doubt is supported by the Morden results which showed no differential variety responses under the treatments applied at essentially the same stage of growth. (Plants 7 to 8 inches tall, sprayed June 19th.). At Morden the averages over all dates and varieties showed significant differences between rates. Following the second spraying at Headingly the yields of Thatcher and Redman were reduced respectively under the 8 ounce rate of ester and the 8 ounce rate of amine. The results of these differences, like those for the first date of Headingly, are doubtful for the reasons already given. (Joint contribution from the Division of Plant Science, University of Manitoba, and the Dominion Experimental Station, Morden.)

Results from teating spring grain crops, sown May 31st and flax sown June 5th with different systemic herbicides, at 2 oz./a rate, 20 days after emergence. 1950. Pavlychenko, Thomas K. Four principal field crops, wheat, oats, barley and flax, were treated in replicated plots at Saskatoon on silty clay loam soil, with 2 oz/a. rates of Weedone Concentrate 48 (ethyl ester of 2, 4-D); Weedone LV 4 (butoxy ethanol ester of 2, 4-D); ACP 638 (2, 4-D acid); ACP 648 and 649 (2, 4-D esters); ACP 646A (2, 4-D acetanilide) and Weedar 64 (2, 4-D amine salt), to test the safety and effectiveness of the new chemicals as compared with commercial esters (Weedone Conc. 48) and amine salts (Weedar 64). The dry weight of weeds and crops and the grain yield of crops was used to measure the performance of each chemical. RESULTS: In check plots (average of 14 replicates) the dry weight of weeds and that of wheat was approximately 1:4; oats 1:6; barley 1:9 and flax 4:1. The corresponding results from Weedone Conc. 48 plots were, for wheat 1:23; oats 1:19; barley 1:48 and flax 1:1. This trend towards higher significant production in the weight of weeds as compared to the weight of crops, with some numerical variations, was quite typical for the other chemicals. The grain yield was higher in most of the treated plots as compared with their checks. Of the 7 chemicals tested, Weedone Conc. 48 gave the highest increase of 9 bu./a. in wheat, followed by Weedar, LV 4, ACP 638 and 648. ACP 646A was very hard on wheat. In oats, Weedar 64 gave the highest increase of 22 bu./a., followed by ACP 646A, LV 4 and Weedone Conc. 48. Of the remaining chemicals, ACP 649 was the hardest on oats. In barley, the highest yield was given by ACP 648, with all other chemicals somewhat reducing the yield. ACP 649 and 646A were the hardest in this respect. In flax the dry weight was highest in ACP 646A, followed by ACP 638 and 648, Weedar 64, ACP 649, Weedone Conc. 48 and Weedone LV 4 in that order. (Contributed by Agr. Div., American Chemical Paint Company, Saskatoon, Sask.).

Results from treating spring grain crops, sown May 19th and flax sown May 22nd, with different systemic herbicides at 2 oz./a. rate, 31 days after emergence, 1950. Pavlychenko, Thomas K. Replicated plots of wheat, oats, barley, rye and flax, on sandy clay loam soil at Saskatoon, were treated with 2 oz./a. rates of W. C. 48 (ethyl ester of 2, 4-D) Weedone LV 4 (butoxy ethanol ester of 2, 4-D), ACP 638 (2, 4-D acid), ACP 648 and 649 (2, 4-D esters), ACP 646A (2, 4-D acetanilide) and Weedar 64 (2, 4-D amine salt) to test the safety and effectiveness of the new chemicals as compared with commercial esters (W.C. 48 and LV 4) and amine salts (Weedar 64). The dry weight of weeds and crops and the grain yield of crops was used to measure performance of each chemical. RESULTS: In check plots (average of 14 replicates) the dry weight of weeds and that of wheat was approximately 1:1; oats

2:3; barley 1:6; rye 1:2 and flax 5:1. Similar data from Weedone Conc. 48 plots was, for wheat 1:14; oats 1:46; barley 1:27; rye 1:20 and flax 2:7. This general trend was quite typical for the other chemicals. The grain yield was significantly higher in all the treated plots as compared with their checks. Of the 7 chemicals tested, ACP 649 gave the highest increase of 19 bu./a. in wheat, followed vy ACP 646A, Weedone Conc. 48, Weedar 64, ACP 638, LV 4 and ACP 648. In oats, LV 4 gave the highest increase of 28 bu./a., followed by ACP 638, Weedar 64, ACP 646A, W.C.48 and other chemicals. In barley, ACP 648 gave the highest yield, followed by ACP 638, LV 4 and ACP 649. ACP 646A was very hard on barley. In rye, ACP 638 gave the highest increase of 11 bu./a., closely followed by LV 4, ACP 649, Weedar 64 and W.C. 48. Flax was frozen prior to maturity and the grain yield could not be determined. The dry weight of top growth was the highest in LV 4, followed by W.C. 48, ACP 649, Weedar 64 and others in decreasing order. (Contributed by Agr. Div., American Chemical Paint Company, Saskatoon, Sask.).

Response of oats to 2, 4-D applied at various stages of growth. Robinson, R. G., R. S. Dunham, and O. H. Shulstad. Separate Mindo oats plots were kept weed-free by cultivation and were sprayed with 12 oz. of 2, 4-D (dimethylamine) per acre every other day beginning in the 2-3 inch stage and continuing until after heading, a period of 38 days. Dates of spraying were replicated 3 times and all data were analyzed statistically. Yields were reduced from every spraying through the full boot stage, a period of 26 days. The most serious reduction occurred when the oats were sprayed at full tiller stage when the yield was reduced by 60%. Moderate to heavy blasting of spikelets followed applications during the boot stage. Treatments delayed maturity from 1-3 days. Germination of the seed from sprayed plots was equal to that from the unsprayed. Results from this and other trials indicate that Mindo is very susceptible to 2, 4-D. (Contribution from the Division of Agronomy and Plant Genetics, University of Minnesota, St. Paul, Minn. Paper No. 719, Misc. Jour. Series, Minn. Agri. Exp. Station.)

Response of oat varieties to 2, 4-D and MCP applied at seedling and full tiller stages. Robinson, R. G., R. S. Dunham, and O. H. Shulstad. Ajax, Andrew, Bonda, Shelby, Clinton, Mindo, and Zephyr varieties were kept weed-free by cultivation and were sprayed (1) when 3 inches tall and (2) in full tiller stage with 12 Oz. of 2, 4-D (dimethylamine) and MCP (amine) per acre. Significant differences in yield of seed occurred only among the earliest varieties; Mindo, Andrew, and Clinton. 2, 4-D reduced yields of Andrew at both stages and Clinton and Mindo at full tiller stage; MCP reduced yields of Clinton and Mindo at the full tiller stage only. All reductions were larger with 2, 4-D than MCP. Germination of the seed from sprayed plots was equal to that from the unsprayed. (Contribution from the Division of Agronomy and Plant Genetics, University of Minnesota, St. Paul, Minn. Paper No. 718, Misc. Jour. Series, Minn. Agri. Exp.Station.)

Effects of 2, 4-D and MCP on Weed-free Nemaha Oats. Shafer, N. E. Hand weeded plots of Nemaha oats were treated at four stages of growth: jointing, early boot, late boot, and flowering. Isopropyl ester at 1/4 # and 1/2 #; butoxy ethanol ester at 1/4 #, 1/2 #, and 1 #; amine salt at 1/2 # and 1 # and amine MCP (2 methyl, 4 chlorophenoxyacetic acid) at 1/2 # and 1 # per acre were applied on all stages of growth. Treatments put on at the jointing stage caused the most injury. All rates of all chemicals gave highly significant reductions in yield when applied at the jointing stage except MCP at 1/2 # and 1 # and amine salt at 1/2 #. Butoxy ethanol ester at 1 # caused a significant reduction in yield when applied at the early boot stage. No other significant reductions were caused in that stage by the other materials used. Treatments made when the oats was in the late boot and also when flowering caused no significant reductions in yields by any rates of chemicals used.

The average yield obtained from all four stages of growth showed the isopropyl and butoxy ethanol esters at all rates and the amine salt at 1 # caused highly significant reductions in yield. Reductions in yield were the direct result of increased floret sterility and reduction in number of florets. Germination was not affected by any of the treatments. (Contribution of the Department of Agronomy, Nebraska Agricultural Experiment Station, Lincoln, Nebraska).

Germination of oats harvested from plots treated with 2, 4-D. Shaw, Warren C., and Willard, C. J. The Clinton 59 oats from the 1949 tests (Res. Rpt. NCWCC, 1949, p. 111c) were germinated. Since the percentage of poorly filled oats was visibly increased by 2, 4-D, the material for germination was chosen by blowing 50 grams of oats with a standard blast for a standard period, and germinating the remaining kernels without selection. The percentage of chaffy kernels blown out was also recorded for each sample. The summary averages of these data for all nine dates is evidendence of injury to germination of oats by high rates of 2, 4-D. At the late joint stage the germination after 2 pounds of the butyl ester was 64-5-31, and after 4 pounds 61-4-35. At the recommended "fully tillered" stage, 1/2 pound of the butyl ester gave 76-2-22, a significant reduction.

Effect of 2, 4-D on Germination of Oats, Average of 9 dates, 1949

Rate of treatment per acre	Blown out after treatment with		Germination(Strong-Weak-dead) after treatment with	
	Amine	Ester	Amine	Ester
Lb.	Pct.	Pct.	Pct.	Pct.
0	1.3	1.3	92-2-6	92-2-6
¼	1.3	1.8	90-2-8	88-2-10
½	1.4	2.5	92-1-7	85-2-13
1	1.6	2.4	89-2-9	84-2-11
2	2.0	3.1	87-2-11	84-3-13
4	2.8	3.2	82-2-16	82-3-15

(Contribution of the Ohio Agricultural Experiment Station.)

The effect of 2, 4-D on spring oats. Slife, F. W. and R. F. Fuelleman. Replicated plots of Clinton oats were sprayed with 2, 4-D amine in the seedling stage, fully tillered stage, and at the jointing stage. Rates of acid per acre used were 1/4, 1/2, 1, and 2 pounds. One-fourth pound had no effect on yield at any of the three stages of growth, but 1/2 pound caused reductions in yield in the seedling and jointing stage. Yields were not reduced with 1/2 pound treatment at the fully tillered stage. The 1 pound rate caused yield reductions on all plots and leaves of the oat plant rolled together after treatment. At 2 pounds per acre there was a severe reduction in yield at all three stages of growth, severe leaf rolling, and the root system of the oat plant partially decayed. Treatments of 1/2 pound or more at the jointing stage caused considerable lodging of the grain. There were very few weeds on these plots. (Conbribution of the Illinois Agricultural Experiment Station, Urbana, Illinois.)

Received too late for summary

Results from treating spring grain crops, sown May 31st, and flax sown June 5th, with different systemic herbicides at 4 oz./a. rate, 20 days after emergence, 1950. Pavlychenko, Thomas K. Replicated plots of wheat, oats, barley and flax, on silty clay loam soil at Saskatoon, were treated with 4 oz./a. of Weedone Concentrate 48 (ethyl ester of 2, 4-D), Weedone LV 4 (butoxy ethanol ester of 2, 4-D), ACP 638 (2, 4-D acid), ACP 648 and 649 (2, 4-D esters), ACP 646A (2, 4-D acetanilide) and

Weedar 64 (2, 4-D amine salt) to test the safety and effectiveness of the new chemicals as compared with commercial esters (Weedone Concentrate 48) and amine salts (Weedar 64). The performance of each chemical was measured by the dry weight of weeds and crops and by the grain yield of crops. RESULTS: In check plots (average of 14 replicates) the dry weight of weeds and that of wheat was approximately 1:5; oats 1:6; barley 1:3 and flax 4:1. In the Weedone Concentrate 48 plots the corresponding figures were, for wheat 1:37; oats 1:24; barley 1:57, and flax 1:2. This general trend towards highly significant reduction of weeds was quite typical in all chemicals. Of the 7 chemicals tested, ACP 648 gave the highest increase in yield of 7 bu./a. in wheat, followed by ACP 649 with an increase of 1 bu./a. All the other chemicals had a depressing effect on the yield, with ACP 646A being the worst. In oats, all the chemicals except Weedone Concentrate 48 and Weedar 64 had a depressing effect on yields, with ACP 638, 648, LV 4 and ACP 646A being the worst, in that order. In barley, ACP 648, Weedone Concentrate 48 and Weedar 64 gave increases, while the other chemicals have depressed the yield. In flax, the dry weight of the top growth was the highest in Weedar 64, followed by ACP 638, 649, LV 4 and others in the decreasing order. (Conbributed by Agr. Div., American Chemical Paint Company, Saskatoon, Sask.).

Results from spring grain crops sown May 19th, and flax sown May 22nd, with different systemic herbicides at 4 oz./a. rate, 31 days after emergence. Pavlychenko, Thomas K. Replicated plots of wheat, oats, barley, rye and flax, on silty clay loam soil at Saskatoon, were treated with 4 oz./a. rates of W.C.48 (ethyl ester of 2, 4-D), Weedone LV 4 (butoxy ethanol ester of 2, 4-D), ACP 638 (2, 4-D acid), ACP 648 and 649 (esters of 2, 4-D), ACP 646A (2, 4-D acetanilide) and Weedar 64 (amine salt of 2, 4-D), to test the safety and effectiveness of the new chemicals as compared to the commercial esters (W.C.48) and amines (Weedar 64). The dry weight of weeds and crops and the grain yield of crops was used to measure the performance of each chemical. RESULTS: In check plots (average of 14 replicates) the dry weight of weeds and that of wheat was approximately 2:3; oats 1:2; barley 1:11; rye 2:3; and flax 3:1. Similar results from Weedar 64 plots were: for wheat 1:18; oats 1:95; barley 1:126; rye 1:26; and flax 2:3. This trend towards highly significant reduction in weeds was typical of all other chemicals, in spite of certain variations in the numerical values expressing these reductions. The grain yields were significantly higher in the great majority of the treated plots as compared to their checks. In wheat, ACP 648 gave the highest increase of 13 bu./a., followed by ACP 638, 649, W.C.48, Weedar 64 and Weedone LV 4. ACP 646A caused some damage to wheat. In oats, ACP 648 also gave the highest increase of 36 bu./a., followed by ACP 638, Weedone LV 4, Weedar 64 and others. In barley, ACP 648 gave the highest increase, of 14 bu./a., followed by ACP 638, Weedone LV 4 and Weedar 64. The remainder of the chemicals, especially W.C.48 and ACP 646A, caused damage (4 to 5 bu./a.) to barley. In rye, W.C.48 gave the highest increase of 11 bu./a., followed by ACP 649 and others; ACP 646A and Weedar 64 caused decrease of 8 and 2 bu./a. respectively. In flax, the dry weight of topgrowth was highest in Weedone LV 4, followed by W.C.48, ACP 638, 649, 648, Weedar 64 and ACP 646A in that order. (Contributed by Agr. Div., American Chemical Paint Co., Saskatoon, Sask.).

PROJECT III. EFFECTS OF HERBICIDES IN GROWING CROPS

Fall-planted Wheat, Oats, and Barley. Investigation leader: W. M. Phillips

Summary

Six stations located in Ohio, Illinois, Nebraska, Kansas, and Oklahoma reported on the effect of 2,4-D on fall-planted wheat. Two stations used 2,4,5-T in addition to 2,4-D. In gerneral the results were similar to those reported in 1949.

Five abstracts showed reductions in yield due to fall application of 2,4-D. In most cases the esters caused greater reductions than the other formulations. Abstracts from Ohio and Hays, Kansas indicate that wheat is most susceptible in its early stages of fall growth.

Only the abstract from Ohio reported significant differences in yields as a result of spring applications. The damage resulted from treatments applied during the joint stage and boot stage and was due largely to rather high rates. Other reports indicated tendencies toward lower yields accompanied by abnormal growth due to treatment during jointing, boot, and soft dough stages.

Two cooperators treated several varieties of winter wheat with a number of formulations of 2,4-D and 2,4,5-T. No differences in varietal susceptibility were evident.

Shaw and Willard report that wheat from plots treated with 2,4-D at rates above 1/2 pound per acre in 1949 during the late joint and bloom stages was significantly lower in germination than untreated wheat. Treatments applied before and after, as well as one stage between these two stages resulted in no apparent loss in germination. They state: "Clearly, however, germination and, presumably, development can be influenced by treating the parent plant with heavy rates of 2,4-D." Studies in previous years at other locations have not shown this effect on germination.

Reports indicate that 2,4-D may increase the protein content of wheat, but this increase is nearly always accompanied by a decreased yield. According to a test in Ohio rates from 1/4 pound to 1 pound 2,4-D applied at the tolerant stages of wheat growth had no effect on milling and baking qualities of soft red winter wheat.

Illinois reported that fall applications of 1 to 2 pounds 2,4-D gave satisfactory control of wild garlic in wheat but that yields were reduced. Spring applications, using heavy rates, resulted in control of aerial bulblets.

The abstracts indicate that fall applications are dangerous and probably should be avoided. Although spring treatment should be avoided whenever possible during the late joint, boot, and bloom stages, wheat appears to be sufficiently tolerant of 2,4-D at other stages to permit spraying at rates necessary to control most weeds. This year 2,4-D and 2,4,5-T gave similar results.

No abstracts were received on winter barley or winter oats.

Abstracts of Results of Cooperators

2,4-D on Thorne wheat. Bernard, R. L., and Willard, C. J. Wheat sowed September 30, 1949, Miami-Brookston soils. Plots 7' x 20', triplicated. An alkanol amine salt of 2,4-D was applied pre-emergence on October 1, and post-emergence at 5 dates in the fall, a week apart, October 22 to November 26, on January 27, and on 8 dates in the spring, approximately 2 weeks apart, March 1 to June 15, at 5 rates each date; 0, 1/4, 1/2, 1, 2 and 4 pounds acid equivalent per acre. Weeds were not a factor in the results.

The results were similar to those of last year (Res. Rept. NCWCC, 1949, p. 74), but 1/4 pound per acre at no time caused significant losses in yield, it did November 23 last year. This year the greatest fall damage was just after germination, and by November 29, even 4 pounds per acre did not significantly reduce the yield. No rate in January or in the spring caused significant damage until jointing. The yield of that treated at the boot stage with 4 pounds per acre was less than 2 bushels per acre. Two weeks later 4 pounds caused no loss. Pre-emergence caused loss at 4 pounds only, but cut yield in half at that rate. (Contribution of the Ohio Agricultural Experiment Station.)

Effect of 2,4-D on six varieties of winter wheat when treated at four stages of growth. Elder, W. C. The 2,4-D was applied in 40 gallons of water at 4 stages of growth and at the rates of 1/4, 1/2 and 3/4 pound acid of ester per acre, and 3/4 pound amine and 3/4 pound acid of sodium salt per acre. Clarkan, Westar, Wichita, Triumph, Pawnee and Comanche varieties of winter wheat were planted on September 15, 1949. The fall tiller stage treatment was made October 23, 1949 after favorable conditions had produced good growth, but before frost. The spring tiller stage was made April 23, 1950 and the boot and dough treatments were made according to variety development. Results were very similar to past years for this test. Analysis for grain yields showed highly significant differences for time of treatment. This was because of reduced yields from the fall application. There was no significant reduction of yields for treatments for any of the other stages of growth. However, it was noticeable in the field that the boot treatment caused bending of the head and there was a slight reduction in total yields where 1/2 and 1 pound of ester was used per acre. All 6 varieties responded alike for all treatments and stages of growth. The ester caused more damage to the wheat than the other formulations for the fall tiller treatment. Three-fourths pound ester per acre lowered yields from 12 to 15 percent for the fall tiller treatment. The amine caused more damage than sodium salt. One-half pound per acre of the ester caused more damage than 3/4 pound amine. One-fourth pound per acre of ester 2,4-D caused only slight reduction of yields in the fall. Fall treatments caused very little onion leaf that has been so noticeable in the past. (Contribution of the Agronomy Department, College of Agriculture, Stillwater, Oklahoma.)

Germination of wheat harvested from plots treated with 2,4-D. Shaw, Warren C., and Willard, C. J. The Thorne wheat from the 1949 tests (Res. Rpt. NCWCC, 1949 p. 74) was germinated. The average check germination (strong-weak-dead) (Av. 40 samples) was 97-5-1.3-1.2. The treated samples were not significantly different from the checks on any dates except May 12 (late joint stage) and June 2 (bloom stage). The germination of grain from plots treated with the butyl ester on May 12 was: 1 lb./A, 93-4-3; 2 lb./A, 94-5-1; 4 lb./A, 87-7-6: on June 2, 1 lb./A, 88-11-1; 2 lb./A, 85-14-1; 4 lb./A, 76-23-1. An apparently complete lack of injury at all rates on May 23, between these dates, is important. Clearly, however, germination and, presumably, development can be influenced by treating the parent plant with heavy rates of 2,4-D. The June 2 treatment did not significantly reduce the yield; the May 23 treatment did. (Contribution of the Ohio Agr. Expt. Sta.)

Effect of several formulations of 2,4-D and 2,4,5-T on six varieties of winter wheat. Phillips, W. M. Comanche, Pawnee, Wichita, C.I.12133, Early Blackhull, and Red Chief winter wheat were treated with isopropyl ester, polypropylene glycol butyl ether ester, and the free acid of 2,4-D and the pentasyl ester of 2,4,5-T. Spray applications were made at 3/4 pound per acre at jointing, boot, and early soft dough stages. There were no apparent differences in yield due to either chemical or stage of growth. The six varieties seemed to be equally tolerant of the chemicals used. In addition Comanche wheat was treated during the boot stage with polypropylene glycol butyl ether ester, butoxy ethanol ester, and polyethylene glycol half ester of 2,4-D and the pentasyl ester of 2,4,5-T at the rate of 1/4, 1/2 and 1 pound per acre. None of the formulations at any rate appeared to effect the wheat adversely. (Contributed by Division of Weed Investigations, Bureau of Plant Industry, Soils and Agricultural Engineering, USDA, Hays, Kansas.)

Yield of winter wheat as affected by late fall applications of 2,4-D. Phillips, W. M. Comanche wheat was seeded at four dates: September 1, September 12, October 3, and October 17. The plots were treated November 15 with an ester and an amine of 2,4-D at 1/2 and 1 pound per acre. When compared with untreated plots the average of all treated plots on each planting date gave the following percentage reductions in yield: September 1--15 %, September 12--15 %, October 3--28 %, October 17--27 %. Wheat planted September 1 and September 12 was well stooled at the time of treatment, while that planted in October was considerably smaller. The younger wheat apparently was more susceptible to 2,4-D. Both formulations caused damage, although in general the ester caused greater injury. In nearly every case the heavier rate resulted in lower yield. "Onion leaf" was common, especially in the plots planted in October. The one pound rate on the late seeded plots appeared to cause some reduction in stand, and also delayed heading and maturity. (Contributed by Division of Weed Investigations, Bureau of Plant Industry, Soils and Agricultural Engineering, USDA, Hays, Kansas.)

Control of wild garlic and wild onion in winter wheat with 2,4-D. Slife, F. W., W. O. Scott, and R. F. Fuelleman. Wild garlic and wild onion have been eradicated by late fall treatment with 2,4-D ester. Treatments over the past three years have been successful on plots receiving 1 to 2 pounds of 2,4-D. Lighter treatments have decreased the garlic population, but have not been effective in eradication. These fall treatments have caused severe reductions in the yield of winter wheat. Spring treatments cannot usually be applied early enough to prevent the formation of underground bulblets on the garlic plants. In 1950, plots were treated on March 10, but underground bulblets were already formed. Early spring applications have reduced wheat yields more than late spring applications. Treatments made in April and May for the past 3 years have indicated that the wheat is more resistant to 2,4-D but the garlic is also more resistant. Rates of 3 pounds 2,4-D acid have given 100 percent control of aerial bulblets when applied in April and May. Lighter rates have given only partial control. One-half pound of 2,4-D acid in early April has reduced the amount of aerial bulblets formed and it has deformed most of the garlic plants so that the bulblets are not harvested with the wheat. In all these tests wild onion seems to be more susceptible to 2,4-D than wild garlic. (Contribution of the Illinois Agricultural Experiment Station, Urbana, Illinois.)

The effect of 2,4-D and 2,4,5-T as selective herbicides on Pawnee winter wheat. Woestemeyer, V. W. Triplicate randomized plots of Pawnee wheat were sprayed with sodium salt, amine and ester formulations of 2,4-D and the ester of 2,4,5-T. Rates of 1/8 to 1 pound of 2,4-D and 3/4 and 1 pound of 2,4,5-T per acre were applied November 12, 1949, (fall tiller), April 20, 1950, (spring full tiller), May 13, 1950, (boot), and June 16, 1950, (soft dough). Plots consisted of two ten-foot rows. Drouth conditions prevailed through the first three stages of treatment. The average yield of check plots was 31.1 bushels per acre. Only fall applications of 2,4-D ester and high rates of amine reduced grain yields. Average yields were 27.4 bushels per acre for one pound of amine, and 31.2, 26.0, 25.4, 23.2 and 26.4 bushels for the 1/8 through 1 pound rates of ester. At heading, some fall treated plots showed stunting, onion leaf and malformed heads, the degree of injury appearing to be closely correlated with grain yields. A delay in maturity of up to ten days was also observed on the fall treated ester plots of 2,4-D and 2,4,5-T. Brittle stems were observed from about the fourth through ninth days after spraying at the fully tillered and dough stages with the heavier rates of amine and esters. No loss resulted at the tillered stage but at the dough stage a good many stems snapped over. These heads were included in yield data. However, counts taken showed the 2,4-D amine to have 12 percent snapped straws, ester 5 percent and 2,4,5-T ester 11 percent at the one pound rates. No damage was observed at rates below 1/2 pound. It is likely that yields of affected plots would be correspondingly reduced under field harvesting conditions. (Contribution of Kansas Agricultural Experiment Station.)

Effect of 2,4-D on milling and baking quality of soft winter wheat. Bode, C. E., Shaw, W. C., and Willard, C. J. The Thorne wheat treated with 2,4-D in 1949 (Res. Rpt. NCWCC, 1949, p. 77) was experimentally milled and baked (cookies) at the Soft Wheat Quality Laboratory, BPISAE, U.S.D.A., Wooster, Ohio. These samples varied in protein content from 10.5 to 16.5 percent. The very high protein content resulting from the application of 4 pounds of 2,4-D per acre at critical stages of growth apparently lowered the flour yield and baking quality of the flour. Rates of 2,4-D ranging from 1/4 pound to one pound per acre applied at tolerant stages of growth had no effect on the milling and baking quality of soft red winter wheat. (Contribution from the Division of Cereal Crops and Diseases, B.P.I.S.A.E., U. S. Dept. of Agriculture, and the Ohio Agricultural Experiment Station.)

The effect of 2,4-D on protein content of Pawnee wheat when yield differences were small. Dayton L. Klingman. Because of a heavy leaf rust infestation of the wheat in the 1949 season, yields were considerably below the potential of moisture and soil fertility. In 10 treatments of 2,4-D ranging from zero to 2 pounds per acre only the 2-pound rate gave an average reduction in yield below the check (see 1949 NCWCC Research Report, page 73). Since the average yields are almost the same for all treatments other than the 2-pound rate, it provides an excellent opportunity for comparison of 2,4-D effects upon protein content without the factor of yield difference entering in. The differences between the protein content of the check plots and that of all the other treatments, excepting the 2-pound rate, were not significant at the 5% level. The 2-pound rate of 2,4-D ester gave a protein content of 14%, differing significantly at the 1% level from the check with 13.4%. This difference in protein content is inversely related to yield which was depressed significantly at the 1% level. When the pounds of protein per acre were calculated from the bushel yield, they ranged from 247.9 per acre for the 1-pound 2,4-D ester to 256.5 pounds for 1-pound 2,4-D amine (not considering the 2-pound ester which yielded 218.4 pounds); the untreated, weed free check gave 250.8 pounds of protein. This is a range of but 8.6 pounds per acre. In this experiment 2,4-D did not affect protein content except when yields were depressed. (Contribution of the Division of Weed Investigations, B.P.I.S.A.E. and the Nebr. Agr. Expt. Sta.)

PROJECT III. CONTROL OF WEEDS IN FIELD CROPS

Flax

P. J. Olson.

Summary.

Twenty four abstracts were received covering work done in South Dakota, Minnesota, Iowa, Manitoba, Saskatchewan and Alberta. Several of the projects reported dealt with the effect of herbicides on the crop rather than on weeds grown in the crop. Of the latter several were concerned with reaction at different stages of growth; others with different chemicals, formulations, brands and rates, and still others with differential response of varieties. Two dealt with fiber flax. Those dealing with weed control in the crop involved both grassy and broad leaved weeds. The chemicals used included 2,4-D (many formulations and brands), 2,4,5-T, T.C.A., Maleic Hydrazide and Methoxone and Endothal.

Five abstracts reported results of treatment with 2,4-D at many stages beginning in early seedling stages or at pre-emergence, and continuing to the bud or advanced bloom stage. One worker spaced his treatments one day apart and others spaced them at intervals varying respectively from 2 to 6 days, so that a large number of stages were covered. All of these reports agree in showing no significant damage from treatments earlier than the bud, or a few days before the bud stage. Within the period from the bud through the full bloom stage the results varied considerably. One worker found severe damage at all stages from pre-bud (33 days after seeding) to full flowering (72 days after seeding). Others found the greatest damage variously before and soon after full bloom. Perhaps some allowance should be made for differences in reading of stage in a crop that tends to be indeterminate in habit of growth under some conditions.

Three workers reported upon differential response of flax varieties to 2,4-D. The results were complicated by rust and frost respectively in two cases. One of the reports showed Royal suffering severe damage, while Sheyenne and Dakota suffered none. In this experiment an effort was made to treat all varieties at the same stages of growth, rather than on the same date. Another worker listed the reduction in yield of five varieties in order of increasing susceptibility. The order was Victory, Redwing, Royal, Rocket, Dakota, Arrow. One worker reported no differential response as between the two varieties Dakota and Rocket

for

One worker applied pre-emergent treatments of 2,4-D/control of mustard in flax using heavy rates, 1 to 2 pounds acid equivalent per acre. Good control of mustard was achieved but the stand of flax was reduced 40 to 50%. Amines and esters were used.

Two workers secured data on the effect of yield of grassy weeds when broad leaved weeds were controlled and vice versa. When 2,4-D was applied for the control of Pennsylvania smartweed increased control accompanied increased concentration of Butyl ester of 2,4-D from 1/4 to 1/2 pounds acid equivalent per acre. As the yield of smartweed was reduced by increasing doses of 2,4-D the yield of green

foxtail was increased. When endothal was applied for the control of wild oats, the yield of broad-leaved weeds was increased. When the yields of flax on treated and untreated plots (broad leaved weeds controlled with 2,4-D,) were compared, there was a sharp reduction in yield on the untreated plots showing marked effect of reduced weed competition.

One worker tested several 2,4-D esters, 2,4-D acid, 2,4-D acetanilide and two amines at 2 and 4 ounces on each of two dates; 20 and 31 days after emergence. All were effective in the control of weeds, but no consistent rank as to order of effectiveness under the 4 tests was established.

Foster (Regina) applied amine powder and found its effect on weeds similar to that of liquid amine. Ialine, an English product, was found similar to the common amines used here. Two low volatile esters were similar to common esters in their effect on the crop and on weeds. Sixteen ounces acid equivalent per acre damaged flax up to 50%.

Methoxone, 2,4,5-T, Maleic Hydrazide were each involved in one abstract.

Methoxone ester and sodium salt each at 4 and 16 ounces acid equivalent per acre controlled mustard completely. The 16 ounce rate reduced the stand of flax up to 30 per cent.

2,4,5-T at 4 and 16 ounces acid equivalent per acre was similar in action to 2,4-D in the control of mustard. At the 16 ounce rate nearly all of the flax was killed.

TCA was applied for the control of wild oats as a pre-emergence spray by Foster of Regina, Sask. and Carder of Beaverlodge, Alberta. Carder obtained fair selectivity between wild oats and flax at 10 pounds per acre, but much less at the higher rates. Foster reported excellent control of wild oats at 40 pounds and above and no severe reduction in stand of flax at rates under 100 pounds. Carder also treated wild oats in peas. He found peas intermediate between flax and wild oats in susceptibility.

Maleic Hydrazide was also applied by Carder for the control of wild oats in flax at rates of 1 to 12 pounds of the active ingredient per acre. The application was made when the flax was 1 inch and the wild oats 1 1/2 to 2 inches tall. Flax proved to be highly susceptible. Wild oats and peas were moderately to highly resistant at the 8 and 12 pound rates.

Mackey and Chubb, Manitoba, reported on the effectof 2,4-D and T.C.A. on fiber flax. No reduction in yield or quality of line fiber was induced by 2 ounces acid equivalent in triethanolamine applied to weed free plots. Isopropyl ester at the same rate caused a slight reduction in both yield and quality.

T.C.A. at 0,40 and 60 lbs. per acre showed respectively 71, 2, and 0 plants of green foxtail per square yard. The corresponding stands of flax were 215, 153, and 125. The surviving plants were "sickly in appearance at harvest and were 6 to 7 inches shorter than those on the checks".

Friesen compared a 2,4-D ester, 2,4-D amine, Methoxone (butyl ester) and Agroxone (Sodium salt) applied to flax infested mainly with red root pigweed and Russian Thistle. Agroxone only stunted the weeds at all rates from 3 to 15 ounces acid equivalent per acre. Methoxone gave good control at 8 and 10 ounces and amine at 6 ounces and over. The ester gave good control at all rates above two ounces. While it was not possible to obtain yield data, because of frost, observations indicated that the flax plants were least affected by Agroxone. Ester had the greatest damaging effect, and Methoxone and the amine were similar in their effects.

Control of weeds in six varieties of flax using three different concentrations of 2,4-D (Butyl ester). Bakke, A. L. and D. W. Staniforth Four blocks of 16 rows each of Koto, Dakota, Minerva, Victory, Redwing, B 5128 varieties of flax were seeded at Kanawna, Iowa on April 19, 1950 where the soil at the time was moist and friable. The ground was heavily infested with Pennsylvania smartweed; there was also considerable foxtail. The plots were wheel-hoed on May 26 and sprayed on June 3 with 1/8, 1/4 and 1/2 pounds acid equivalent per acre, butyl ester formulation of 2,4-D, when the flax was 3-6 inches. The plots were harvested on August 11. There was no significant difference in yield except for Koto which was low. Where no treatment was given the average yield of all varieties was 16.6 bu./A.; 1/8 lb., 19.9 bu.; 1/4 lb., 19.9 bu.; 1/2 lb. 19.6 bu. At the time of harvest the weeds were removed from one half of each row, 7-1/2 square feet and air dried. There was a decrease in the amount of smartweed with increase in the concentration of 2,4-D. Since 2,4-D applied as a post emergence spray is not effective in the control of grasses, it was expected that there would not be a decrease in the foxtail, with an increase in the concentration of 2,4-D. The air-dry weight of the foxtail taken from the flax sprayed with 1/2 lb. 2,4-D per acre was almost twice that of the control. (Contribution from Iowa Agricultural Experiment Station).

Effect of 2,4-D on two varieties of flax. Breakey, W. J. The ester and amine formulations of 2,4-D were sprayed at the rates of 3 and 5 ozs. acid equivalent per acre on flax seedlings containing 8 to 10 leaves. Simple split plot randomization, with three replications for each treatment were used. Plots of two varieties, Dakota and Rocket, were sprayed the same day. All plants of both varieties after spraying with the two rates were prostrate two days after spraying. Plants slowly returned to upright position by the end of two weeks, with the exception of the ester sprayed at the 5 oz. rate which required a further week at the heavier rate before returning to upright position. The variety Dakota became heavily infested with rust and later was attacked by pasmo. All plots of Dakota, including the checks, were lodged. Dakota did not ripen naturally, the straw was brittle and dry. Dakota showed much susceptibility to rust. The yield of Dakota was reduced 35 to 50% by the rust epidemic. The average for check plots of Rocket was 41.4 bushels per acre as against 21.4 for Dakota. The ester at 5 ozs. acid per acre reduced the yield of both varieties 10.5 bushels per acre, while the yield at the 3 oz. ester treatment was reduced 4.7 bushels for Dakota and 6.9 bushels for Rocket. The yields from the 5 oz. amine treated plots for both varieties were significantly lower, while the yield from the 3 oz. amine treatment was not. (Contribution from the Dominion Experimental Station, Morden, Man.)

The selective control of wild oats in flax and in peas by TCA and Maleic Hydrazide. Carder, A. C. Five rates of TCA, nil, 10, 20, 40 and 60 pounds acetate equivalent per acre were applied to Redwing flax and Chancellor peas one day after they had been seeded in land heavily infested with wild oats (Avena fatua). Later, when the flax had emerged 1 inch, the peas 1 1/2-2 inches, and the wild oats 2 inches, Maleic Hydrazide was applied at six rates: nil, 1, 2, 4, 8 and 12 pounds of the active ingredient per acre. Examination 2 months subsequent to treatment indicated that the wild oats were more susceptible

to the pre-emergence TCA application than were either flax or peas, and that the latter were intermediate to the wild oats and flax in their susceptibility. Ten pounds of TCA reduced the vigour of the wild oats 83 and that of the flax 45 per cent. The higher rates showed much less selectivity. Yield data, rendered extremely light by June drought and mid-August frost, indicated 19 and 64 per cent reduction in clean flax seed by the 10- and 20-pound rates, respectively. The post-emergence treatment of Maleic Hydrazide indicated a high susceptibility of flax to this chemical, while both peas and wild oats possessed moderate tolerance. Thus, 8 pounds of Maleic Hydrazide per acre stunted growth of flax to 5 per cent of that on the untreated controls, while the peas and wild oats retained 90 per cent of their vigour. (Contribution from Dominion Experimental Station, Beaverlodge, Alberta.)

Effect of T.C.A. on fibre flax. Chubb, W. O. and E. M. MacKey. In 1950 1/160 acre plots of Liral Dominion flax were sprayed with 0, 40 and 60 lb. acid equivalent of sodium T.C.A. immediately after seeding. Treatments were carried out in triplicate. The flax emerged 6 days after seeding. Visible signs of injury appeared 16 days after seeding for the 60 lb. and 20 days after for the 40 lb. treatment. Both treatments retarded flowering 3 days. 79 days after seeding stand counts on all treatments differed; the mean counts per yard of row, in order of increasing treatment were 215, 153 and 125. Plants surviving on treated plots were sickly in appearance at harvest and were 6 to 7 inches shorter than those on the checks. Field observations suggest that mortality, on the 60 lb. plot at least, would have been much greater if there had not been so much cool rainy weather during the growing season. Counts of green foxtail (37 days after treatment) on the 40 and 60 lb. plots did not differ significantly and were lower than those on the checks. Mean counts per square yard for the 0, 40 and 60 lb. treatments were respectively 71, 2 and 0. (Contribution from the Dominion Experimental Farms Service, Pilot Flax Mill, Portage la Prairie, Man., Canada.)

Differential response of six varieties of flax to 2,4-D. Coupland, R. T. and J. F. Alex. 2,4-D amine (a mixture - Naugatuck) and ester (butyl) at 0, 4 and 8 oz. of acid per acre were applied to quadruplicated, weed-free plots in a randomized block design in two stages of development. Stage 1, June 13, when the flax was 2-3 inches high with 15-20 leaves; stage 2, July 5, when the flax was 15 inches high and in bud to early flower. Killing frosts during mid August caused considerable frost damage (about 95 days after seeding). The data at harvest reflect the effect of 2,4-D as modified by frost damage. The order of the varieties from most resistant to susceptible on the basis of yield decrease caused by treatment was Victory, Redwing, Royal, Dakota, Rocket and Arrow. In the first stage amine at 4 oz. caused a 17% increase to a 7% decrease in yield in different varieties. The corresponding figures for amine at 8 oz. were 19% increase to 6% decrease, for ester at 4 oz. were at 11% increase to 12% decrease, and for ester at 8 oz. were 20% increase to 26% decrease. At the second stage amine at 4 oz. caused a 13% increase to 16% decrease. amine at 8 oz. caused a 34 to 58% decrease, ester at 4 oz. caused a 31 to 52% decrease and ester at 8 oz. a 52 to 76 decrease. Delay in maturity was caused by treatment, in order of increasing delay, as follows: Rocket, Dakota, Victory, Redwing, Royal and Arrow. The range

in the first stage was from an average advance of 8 days in maturity date with amine at 4 oz. on Rocket to a 6-day delay caused by 8 oz. of ester on Arrow. In the second stage Rocket was not delayed by 4 oz. of amine, while the greatest delay was an 18-day one on Arrow from 8 oz. of ester. Order of frost damage, as indicated by percentage of damaged seeds, was Redwing, Victory, Rocket, Dakota, Royal and Arrow. (Contribution from the Department of Plant Ecology, University of Saskatchewan, Saskatoon.)

An ecological study of the effects of 2,4-D, endothal and annual weeds on flax yields at Brookings, S. Dak. in 1950. Derscheid, Lyle A. J. M. Aikman. Quintriplicate 8' x 16' plots were seeded to Dakota flax. Three plots were kept weed-free, three seeded to wild mustards and foxtails primarily, but some wild oats, and broad-leaved weeds were also seeded. A seventh plot was seeded to the broad-leaved weeds and an eighth to the grassy weeds. Plots 7 and 8 as well as one weed-free and one mixed weedy plot were not treated with chemicals but one weed-free and one mixed weed plot were treated with the alkanol amine of 2,4-D at the rates of 1/4 lb. of acid equivalent per acre and two similar plots were treated with 3/4 lb. acid equivalent of endothal. Flax seed and straw yields varied together and were not affected by either chemical. Mean yields of 22.8 bu./A and 0.63 T/A from weed-free plots were significantly higher than mean yields of 15.6 bu./A and 0.42 T/A from weedy plots. The yields of 18.9 bu./A and 0.51 T/A from grassy weed plots were significantly higher than the mean yields of 14.7 bu./A and 0.40 T/A from plot containing broad-leaved weeds. The mean yield of broad-leaved weeds, 0.47 T/A from 2,4-D treated plot was significantly lower than the mean yield 0.65 T/A from untreated plots. The yield of grassy weeds, 0.15 T/A from endothal treated plots was significantly lower than the yield, 0.30 T/A of untreated plots. When grassy weeds were partially controlled with endothal, the broadleaved weed yield increased 0.19 T/A. Due to unusually cool and otherwise abnormal growing conditions, 2,4-D was not as effective as usual and therefore the effect of endothal may not have been typical. (Contribution from Agronomy Department of South Dakota Agricultural Experiment in co-operation with the Botany Department at Iowa State College.)

Effect of 2,4-D and MCP on flax with and without weeds. Dunham, R. S., and R. G. Robinson. Redwood and Minerva varieties were sprayed when 4-6 inches tall with 4 oz. of 2,4-D (dimethylamine) and 2, 3, 4, and 6 oz. of MCP (amine) per acre. One set of plots for each variety was kept weed-free by cultivation. In a second set, wild mustard was sown in the row with the flax, but the space between rows was cultivated. With both varieties of flax plus weeds, yields were much higher than the unsprayed for both seed and straw. There was no significant differences between yields from the different dosages and chemicals but more mustard was killed by 4 oz. of MCP than 4 oz. of 2,4-D. Both varieties showed marked response after spraying with 6 oz. of MCP by twisted plants, delay in blooming, and shortness of growth. There were no significant differences, however, between yields of seed or straw from any of the weed-free plots whether treated or not. (Contribution from the Division of Agronomy and Plant Genetics, University of Minnesota, St. Paul, Minn. Paper No. 721, Misc. Jour. Series, Minn. Agri. Exp. Station.)

Pre-emergence treatments with flax. Foster, J. Roe. Different rates of amine and ester formulations of 2,4-D, including two low volatile esters, and 2,4,5-T were applied to Royal flax. The stand of flax was reduced by applications of one pound or more of acid per acre of all the chemicals used. One of the low volatile esters and the amine 2,4-D reduced the stands of flax 50% and 40% respectively when applied at the 2-pound rate. Wild mustard (Sinapis arvensis) were well controlled by all treatments. A delay in flowering resulted from all treatments, and this delay increased with increased rates of application. One of the low volatile esters retarded flowering as much as 6 days. Due to damage from heavy August frosts no yield data are available. (Contribution from the Dominion Department of Agriculture, Experimental Farms Service, Dominion Experimental Sub-Station, Regina, Saskatchewan, Canada.)

Effect of 2,4-D on flax when applied at different growth stages. Foster, J. Roe. Ester, amine, and sodium salt formulations were applied to Royal flax daily whenever weather conditions permitted, at rates of 2,4 and 8 ounces of acid per acre. The first application was made before emergence, and the last 15 days after flowering. The longest interval between sprayings was 4 days. Lodging took place after all treatments from shortly after emergence until blossoming, but the flax righted itself again in a week's time. Permanent deformities occurred from ester treatments made between the 15th and 38th day after emergence, or until flowering. Permanent deformities resulted from amine treatments made between 15 and 25 days after emergence. All treatments caused delay in flowering. The most severe delay was from treatments made within a week of the normal flowering date. At this time the ester delayed flowering up to 3 weeks, and amine up to 13 days. Due to heavy August frosts, no yield data are available. (Contribution from the Dominion Department of Agriculture, Experimental Farms Service, Dominion Experimental Sub-Station, Regina, Saskatchewan, Canada.)

Trichloroacetic acid as a pre-emergence treatment to control wild oats in flax. Foster, J. Roe. Trichloroacetic acid (T.C.A.) was applied immediately after seeding to Royal flax at rates of 10, 20, 40, 60, and 100 pounds per acre. The 10 and 20 lb. applications reduced the number of wild oats (Avena fatua) by 25% and 50% respectively. The 40 lb. rate reduced the wild oats 91%, and the remaining plants were small and lacked vigour. The 60 and 100 lb. rates were no more effective than the 40 lb. rate in controlling the wild oats. Wild mustard was also controlled by applications of 20 lbs. or more of T.C.A. The stand of flax was reduced 10% by the 20, 40, and 60 lb. rates, and 35% by the 100 lb. rate. The 40 lb. rate delayed flowering 1 day, while the 60 and 100 lb. rates delayed flowering 18 days. Yield tests were not available due to heavy frost damage in August. (Contribution from the Dominion Department of Agriculture, Experimental Farms Service, Dominion Experimental Sub-Station, Regina, Saskatchewan, Canada.)

Trials with new 2,4-D products. Foster, J. Roe. An amine 2,4-D in powder form to be used as a spray was very easily dissolved in water. Its effect on weeds was very similar to a common liquid amine. The powder form retarded flowering in flax 3 to 4 days more than the liquid form did. Heavy rates (16 ounces) caused damage to

flax up to 50%. (Contribution from the Dominion Department of Agriculture, Experimental Farms Service, Dominion Experimental Sub-Station, Regina, Saskatchewan, Canada.)

Trials with methoxone. Foster, J. Roe. Sodium salt and ester forms of methoxone were applied to Thatcher wheat, Exeter oats, Montcalm barley and Royal flax at 4 and 16 ounces acid per acre. The flax was damaged and the stand reduced up to 30% with the 16 ounce rates. (Contribution from the Dominion Department of Agriculture, Experimental Farms Service, Dominion Experimental Sub-Station, Regina, Saskatchewan, Canada.)

Trials with 2,4-5-T. Foster, J. Roe. 2,4,5-T was applied to Thatcher wheat, Exeter oats, Montcalm barley, and Royal flax at 4 and 16 ounces of acid per acre. In the flax the 4-ounce rate caused curling and yellowing of the plants, and with the 16-ounce rate the flax was nearly all killed. (Contribution from the Dominion Department of Agriculture, Experimental Farms Service, Dominion Experimental Sub-Station, Regina, Saskatchewan, Canada.)

The effect of 2,4-dichlorophenoxyacetic acid on Redwing Flax sprayed at 3 day intervals. Leggett, H. W. The plots were sprayed every 3 days from 6 until 87 days after seeding with 8 oz. of 2,4-D acid per acre of the Butyl Ester formulation. Observations made in the field showed very clearly that the flax sprayed in the early stages was much the best. . Flax sprayed in the advanced stages* was very badly damaged. These observations were borne out by the yields. Plots sprayed from 6 until 24 days after seeding produced yields not significantly different from the check plots. The flax plants in the above period were sprayed in stages from pre-emergence to the 14 true-leaf stage. The plots sprayed 27 and 30 days after seeding were delayed in maturity from 6 to 10 days, and if we had not had an early frost, would have matured and produced yields comparable to the check plots. The critical period when the flax was damaged beyond recovery was from 33 to 72 days after seeding, or from the pre-bud to full flowering stage of growth. The plots in this range gave yields which were significantly lower than the check plots. As soon as the bolls had formed there was no decrease in yield from the 2,4-D treatment. Spraying at this late stage did, however, appear to weaken the straw and the plots lodged slightly. A high rate such as was used in this experiment is not recommended, but it does help to clarify the stages in which flax can be sprayed successfully. (Contribution of the Dominion Experimental Station, Lacombe, Alberta.) * of growth, from the pre-bud stage through to the flowering stage,

Application of TCA for the control of annual grasses in flax in 1950 at Milbank, South Dakota. MacDonald, W. P.; Zinter, C.C., Slough, A. T. 90% sodium TCA was applied June 23 at 10 and 13 1/2 lbs. of acid equivalent per acre. Also 5 lbs. of TCA was applied with 4 ounces of an alkanolamine 2,4-D. The 10-lb. rate was applied as a spray solution with 10 and 20 gals. of water per acre. All other plots were applied at 10 gals. of solution per acre. At the time of treatment the flax (B-5128) was 3 to 5 inches high, badly infested with setaria which was 2 to 5 inches high. No injury to flax was observed at any rate. Estimated control of setaria August 1, 1950: 13 1/2, 85%; 10 lbs. (20 gals.) 83%; 10 lbs. (10 gals.) 80%; 5 lbs. TCA, 4 ounces 2,4-D, 60%. Control of annual broad-leaves where the combination of

chemicals was used, was satisfactory and equal to a like quantity of 2,4-D used alone. (Contribution from Agr. Dept., F. H. Peavey & Co., Minneapolis, Minn.)

Application of TCA for the control of annual grasses in flax in 1950 at Danvers, Minn. MacDonald, W. P.; Zinter, C.C.; Slough, A.T. 90% sodium TCA was applied June 14 at the following rates of acid equivalent per acre - 10 lbs. in 20 gals. of water; 10 lbs. in 10 gals.; 5 lbs. in 10 gals.; and 10 lbs. with 4 oz. alkanolamine of 2,4-D in 20 gals. of water. At the time of treatment the flax (Koto) was 5 to 6 inches high and heavily infested with setaria, which was 4 to 6 inches high. No injury to flax was observed at any rate. Estimated control of Setaria Aug. 1, 1950 - 10 lbs. TCA & 20 gals. water, 98%; 10 lbs. & 10 gals., 99%; 5 lbs. & 10 gals., 96%; 10 lbs., 4 ounces 2,4-D and 20 gals., 97%. Where the combination of TCA and 2,4-D was used, control of mustard was satisfactory and equal to a like quantity of 2,4-D used alone. (Contribution from Agr. Dept. F.H. Peavey & Co., Minneapolis, Minn.)

Effect of 2,4-D on fibre flax - 1949. MacKey E. M. and W. O. Chubb. In one test Liral Dominion, Liral Prince, Toba and Royal flax were sprayed with 2 oz. acid equivalent of triethanolamine when at the 2 to 6 inch and early bud stages. In a second test the same varieties were sprayed with 2 oz. acid equivalent of triethanolamine, isopropyl ester and sodium salt when 2 to 6 inches tall. In a third test, Liral Dominion was sprayed with 0, 2, 4 and 8 oz. acid equivalent of triethanol amine soon after the 5 true leaf stage. Plots for these tests (1/160 acre) were weeded. In a fourth test Liral Dominion was given the same treatments as in the third plots (1/80 acre) were not weeded. In all trials treatments were carried out in triplicate and untreated checks were included. The growing season was very dry. There were no differences in yield or quality of line or total fibre among treatments in the first test. In the second test there were no differences in yield or quality of line or total fibre between checks, amine or sodium salt formulations. There was only a borderline effect (reductinn) on line yield produced by the ester treatment. On the weeded plots the 8 oz. amine spray caused a slight reduction of line and total fibre yields and the line was shorter and of poorer quality than that yielded by flax on the checks. On the weeded plots, which were only lightly infested, the 8 oz. treatment caused no such reductions in yield or quality of fibre. Two different triethanolamine formulations were used. (Contribution from the Dominion Experimental Farms Service, Pilot Flax Mill, Portage la Prairie, Man., Canada.)

Reaction of flax to 2,4-D applied at different stages of growth. P. J. Olson. Butyl ester was applied to flax at 23 stages of growth in 1949 and isopropyl ester at 20 stages in 1950. The treatments were begun shortly before emergence and were continued at 3-day intervals until well past full bloom. The rate of application was 8 ounces per acre acid equivalent in 1950 and 5 ounces in 1949. The results for both years showed that the most susceptible period was when the plants were from 6 to 10 days past full bloom. The reduction in yield was about 50 per cent for both years. Another highly susceptible period was in the bud to early bloom stage. This period extended over 6 to 9 days, being somewhat longer in 1949 than in 1950. Prior to this period

no damage of consequence was done in either year. Between these two periods no significant damage was done in 1950. In 1949 significant yield reduction took place over a period from 4 days past to 21 days past full bloom, but the two treatments respectively at 6 and 10 days past full bloom resulted in much the most severe damage. (Contribution from the Division of Plant Science, The University of Manitoba, Winnipeg.

Differential response of three varieties of flax to treatment with 2,4-D. Olson, P. J. Sheyenne, Dakota and Royal flax were treated with alkanol amine and isopropyl ester in 1950. Each formulation was applied at two rates, namely 3 and 6 ounces acid equivalent per acre. The applications were made on two dates, the first on July 5th, when Sheyenne was 6 inches, Dakota 5 1/2 inches, and Royal 4 1/2 inches tall (seeding date June 2nd.) and the second on July 17th. for Sheyenne, July 21st for Dakota and July 25th for Royal. On these dates 10-20 per cent of the plants were in bloom in all three varieties. No significant reduction in yield took place at either date in the case of Sheyenne and Dakota. Royal was reduced significantly by all treatments at both dates. The reduction was particularly severe under the the 6 oz. ester treatment at the second date. The yield of the check was 22.7 bu. and that for the 8 oz. ester treatment 12.5. (Necessary difference at the 5% level 2.2 bushels.) (Contribution from the Division of Plant Science, The University of Manitoba.)

Results from treating spring grain crops, sown May 31st and flax sown June 5th. with different systemic herbicides, at 2 oz./a. rate, 20 days after emergence, 1950. Pavlychenko, Thomas K. Four principal field crops, wheat, oats, barley and flax, were treated in replicated plots at Saskatoon on silty clay loam soil, with 2 oz./a. rates of Weedone Concentrate 48 (ethyl ester of 2,4-D); Weedone LV 4 (butoxy ethanol ester of 2,4-D); ACP 638 (2,4-D acid); ACP 648 and 649 (2,4-D esters); ACP 646A (2,4-D acetanilide) and Weedar 64(2,4-D amine salt), to test the safety and effectiveness of the new chemicals as compared with commercial esters (Weedone Conc. 48) and amine salts (Weedar 64). The dry weight of weeds and crops and the grain yield of crops was used to measure the performance of each chemical. Results: In check plots (average of 14 replicates) the dry weight of weeds and that of flax was 4:1. In flax the dry weight was highest in ACP 646A, followed by ACP 638 and 648, Weedar 64, ACP 649, Weedone Conc. 48 and Weedone LV 4 in that order. (Contributed by Agr. Div., American Chemical Paint Company, Saskatoon, Sask.).

Results from treating spring grain crops, sown May 19th and flax sown May 22nd, with different systemic herbicides at 2 oz./a. rate, 31 days after emergence, 1950. Pavlychenko, Thomas K. Replicated plots of wheat, oats, barley, rye and flax, on sandy clay loam soil at Saskatoon, were treated with 2 oz./a. rates of W.C. 48 (ethyl ester of 2,4-D), Weedone LV 4 (butoxy ethanol ester of 2,4-D), ACP 638 (2,4-D acid), ACP 648 and 649 (2,4-D esters), ACP 646A (2,4-D acetanilide) and Weedar 64 (2,4-D amine salt) to test the safety and effectiveness of the new chemicals as compared with commercial esters (W.C.48 and LV 4) and amine salts (Weedar 64). The dry weight of weeds and crops and the grain yield of crops was used to measure performance of each chemical. Results: In check plots (average of 14 replicates) the dry weight of weeds and that of flax was 5:1. (Contribution from Agr. Div., American Chemical Paint Company, Saskatoon, Sask.).

Results from treating spring grain crops, sown May 31st, and flax sown June 5th, with different systemic herbicides at 4 oz./a. rate, 20 days after emergence, 1950. Pavlychenko, Thomas K. Replicated plots of wheat, oats, barley and flax, on silty clay loam soil at Saskatoon, were treated with 4 oz./a. of Weedone Concentrate 48 (ethyl ester of 2,4-D), Weedone LV 4 (butoxy ethanol ester of 2,4-D, ACP 638 (2,4-D acid), ACP 648 and 649 (2,4-D esters), ACP 646A (2,4-D acetanilide) and Weeder 64 (2,4-D amine salt) to test the safety and effectiveness of the new chemicals as compared with commercial esters (Weedone concentrate 48) and amine salts (Weedar 64). The performance of each chemical was measured by the dry weight of weeds and crops by the grain yield of crops. Results: In check plots (average of 14 replicates) the dry weight of weeds and that of flax was approximately 4:1. In flax, the dry weight of the top growth was the highest in Weedar 64, followed by ACP 638, 649, LV4 and others in the decreasing order. (Contributed by Agr. Div., American Chemical Paint Company, Saskatoon, Sask.)

Results from spring grain crops sown May 19th, and flax sown May 22nd, with different systemic herbicides at 4 oz./a. rate, 31 days after emergence. Pavlychenko, Thomas K. Replicated plots of wheat, oats, barley, rye and flax, on silty clay loam soil at Saskatoon, were treated with 4 oz./a. rates of W.C. 48 (ethyl ester of 2,4-D), Weedone LV4 (butoxy ethanol ester of 2,4-D, ACP 638 (2,4-D acid), ACP 648 and 649 (esters of 2,4-D), ACP 646A (2,4-D acetanilide) and Weedar 64 (amine salt of 2,4-D), to test the safety and effectiveness of the new chemicals as compared to the commercial esters (W.C. 48) and amines (Weedar 64). The dry weight of weeds and crops and the grain yield of crops was used to measure the performance of each chemical. Results: In check plots (average of 14 replicates) the dry weight of weeds and that of flax was approximately 3:1. In flax, the dry weight of topgrowth was highest in Weedone LV4, followed by W.C. 48, ACP 638, 649, 648, Weedar 64 and ACP 646A in that order. (Contribution from AGR. Div., American Chemical Paint Co., Saskatoon, Sask.)

Effect of 2,4-D applied at different growth stages for weed control in flax. Sexsmith, J. J. Quadruplicate treatments of triethanol amine salt and butyl ester of 2,4-D, each at rates of 3 and 6 ounces free acid per acre, were applied to Dakota flax at six dates. First treatments were applied 10 days after seeding when flax was just emerging. Subsequent treatments were applied at 5 day intervals with exception of 4th treatment which was applied 10 days after 3rd treatments. Sixth treatment was applied when flax was approximately 7 inches tall and in late pre-bud stage. Best weed control was obtained with 6 ounces ester applied at 4th, 5th, and 6th dates, closely followed by amine 6 ounces at same dates. Ester 3 ounces gave almost same control as amine 6 ounces, and amine 3 ounces did not give sufficient control to be of practical value. All treatments delayed maturity, which for an average of treatments at all dates, ranged from 6 days delay for amine 3 ounces to 11 days for ester 6 ounces. Second date applications caused more serious maturity delay than applications made at the other dates. Yield increases ranged from 9% for 5th date treatments to 24% for 1st date treatments, and 6th date treatments decreased yields slightly when compared with untreated check yields. Third and 4th date treatments gave most satisfactory yields consistent with good weed control. These treatments were applied 10 and 20 days after emergence and gave yield increases of 20% and 17% respectively. (Contribution from Dominion Experimental Station, Lethbridge, Alberta.)

Project III. Control of Weeds in Field Crops.

Corn. C. J. Willard

Summary

Pre-emergence applications. Nine abstracts from six states reported work on pre-emergence treatment of corn, and in addition two states reported successful very early post-emergence treatments with 2,4-D at pre-emergence rates. Two states reported on 2,4-D only: four included other chemicals. The soils, except for one loam, were silt loams.

A laboratory study of the behavior of 2,4-D solutions added to montmorillonite and sand indicated that the butyl ester was less readily moved in the soil and hence safer for pre-emergence use than the amine salt, if rains follow shortly after the 2,4-D application.

Slight damage from 2 4-D pre emergence at 2 lb./A. was reported by one station: no others reported significant injury at 2 lb./A. or less. One pound per acre gave good, sometimes complete, control of weeds. There were significant differences between formulations, but these were less important than their general success. For economy and greater safety, it would seem wise to use 1 or 1½ lb./A. even though a few weeds slip through. We must cultivate at least once to control resistant weeds and, on many soil types, to break up crusts and let water into the soil. Pre-emergence 2,4-D, especially esters, seems desirable to use at those rates. One state reported differences in hybrids, as heretofore, but they were unimportant at the lower rates.

Most of those reporting applied 2 4-D several days after planting, as has been repeatedly shown to be safer where rain follows at once after treatments. Two abstracts this year report applying 1½, 2, and even 4 lb /A. of esters to corn in the 3-leaf stage without other than temporary injury and complete weed control, even at 1 lb. This extension of "pre-emergence" sprays may be highly important.

Dinitros gave fair to excellent weed control and little or no damage to corn - in one test with pop-corn, and one with field corn, a significant increase in yield.

Xanthogen disulfide was uniformly ineffective and unsatisfactory in all but one test - no harm to the corn little harm to the weeds.

Sodium 3,6-endoxohexahydrophthalate (E.C. 3740) gave good control of grass, some effect on broadleaved weeds, no effects on corn in one test, no effects on anything in another.

Sodium 2,4-dichlorophenoxy ethyl sulfate (E.H. No. 1) gave some promise, but stunted corn severely at 8 lb./A., and at 4 lb. in one test. Dichloral urea (E.H. No. 2) also stunted corn at 4 and 8 lb./A. Sodium PCP gave 100 percent control of purslane in one test on pop-corn.

Post-emergence applications. Abstracts from seven states and one corporation reported post-emergence treatments to corn, mostly on special problems, which reflects a high degree of satisfaction with previous recommendations. One concerned partially successful attempts to control grass weeds appearing after

the normal time of laying by, with no one chemical outstanding: one reported 2,4,5-T less harmful to corn than 2,4-D (amines of each): one reported 1/4 lb./A. postemergence inferior to 2 lb. pre-emergence as a 4-year average: one studied repeated applications of 2,4-D, of which no summary is possible, but which pointed up delayed maturity as a result of 2,4-D treatments: one reported general susceptibility of inbred lines to postemergence treatment: one studied the effects of heavy applications of an ester every alternate day from 3" to 12" high - no effect on tasseling, good weed control, little or no injury to small corn, severe injury at the 4-leaf stage and later.

Three abstracts compared 2,4-D formulations. The "low-volatile" esters were slightly more effective on both weeds and corn than the alkyl esters, and these, of course, than the amine salts.

Abstracts of Results of Cooperators

Factors affecting pre-emergence results with 2,4-D. Richard J. Aldrich and C. J. Willard. Laboratory experiments were conducted to obtain fundamental information concerning germination inhibition and other effects resulting from pre-emergence applications of 2,4-D to corn and soybeans. Tests were also made on the fixation of different 2,4-D formulations by clay colloids. A layer of 2,4-D below the seeds or at the soil surface did not affect the emergence of either soybeans or corn. 2,4-D at the seed level severely reduced emergence of both species, with very great reduction of soybeans. Applications of lanolin containing 2,4-D to various parts of corn seedlings indicated pronounced differences between treatments at different locations. There was apparently very little translocation of 2,4-D from the root to the shoot or from the shoot to the root. Both the amine salt and butyl ester formulations of 2,4-D were "fixed" by a naturally occurring montmorillonite type of clay. The ester was fixed to a much greater extent than was the amine, and the ester was also held more tightly. This would indicate that esters would be safer for pre-emergence use than amine salts and an experiment in which 2,4-D was irrigated in demonstrated the difference. (Contribution of Ohio Agricultural Experiment Station.)

The relative response of corn and sorghum to 2,4-D and 2,4,5-T. K. C. Barrons. Two corn inbreds and three sorghum varieties known to vary in their reaction to 2,4-D were treated on two dates with different rates of amine formulations of 2,4-D and 2,4,5-T. The average response of sorghum to 2,4,5-T was far less than to 2,4-D. The difference was very pronounced with Wheatland, a variety known to be highly sensitive to 2,4-D. With corn the difference was less pronounced. However in some instancesthere was definitely less malformation of adventitious roots following spraying with 2,4,5-T than with identical rates of 2,4-D. These field-plot results confirm laboratory and greenhouse tests by the writer which indicated less response of corn and sorghum to 2,4,5-T than to 2,4-D. They are also in agreement with the results of corn root activity tests reported by Thompson et. al. (Botanical Gazette 107:476-507. 1946.) The difference in response of sorghum to the two compounds is sufficient to suggest the desirability of further field tests with 2,4,5-T as a selective herbicide for this crop. (Contribution of the Dow Chemical Company.)

The effect of repeated applications of 2,4-D on corn. R. Behrens. Inbred M-14 was planted May 23, 1950 in a randomized complete block with 4 replications. Plots of 28 plants were repeatedly sprayed at intervals of 3, 6, 9 and 12 days with 2 rates (1/8 and 1/2 lb. per acre) of 2,4-D amine using spray equivalent to 20 gallons per acre. Applications were started when the corn was 6 to 8 inches high and continued through the pollinating period. Plots sprayed every third day received 15 applications. The heaviest application equaled a rate of 7½ lbs. per acre. Plots with 1/2 lb. rates at 3 and 6 day intervals appeared to have narrower leaves and reduced total leaf area. Only plots sprayed with 1/2 lb. at 3 day intervals showed any great degree of stalk bending. After the first 2 applications the degree of stalk bending remained about constant. There was a significant reduction in whole plant dry matter percent in all treated plots. Whole plant dry matter percent ranged from 23.3% to 25.6% for treated plots with controls averaging 26.2%. This indicates that treated plants were less mature at harvest time. Spray applications at pollination had no effect on fertilization. There was a highly significant reduction in whole plant dry matter on all plots treated with 1/2 lb. per acre rates regardless of spray interval. Rates of 1/8 lb. applied at 3 and 6 day intervals caused a significant reduction in whole plant dry matter but 1/8 lb. rates at 9 and 12 day intervals caused no significant reductions. Total ear dry matter per plot showed a highly significant reduction due to 1/2 lb. rates applied at 3 and 6 day intervals being 65 and 80 percent respectively. Other rates and intervals of application caused no significant difference in ear dry matter. No significant increase in dry matter produced was noted following any of the treatments. (Contribution from Department of Agronomy, Wisconsin Agricultural Experiment Station.)

Effect of 2,4-D on corn yields. Churchill, B. R. and B. H. Grigsby. Data from randomized and replicated plots were secured for four years. Postemergence spraying at 1/4 pound acid equivalent per acre was compared with pre-emergence spraying at 2 pounds per acre, with cultivation, and in combinations of spraying and cultivation on a Brookston loam soil. Neither ordinary cultivation nor post nor pre-emergence spraying were effective in keeping out weeds late in the season. Spraying without cultivation gave lower yields of corn than spraying followed by cultivation. Yields from pre-emergence sprayed plots regardless of cultivation were higher than those from postemergence sprayed plots. Either post or pre-emergence spraying in combination with cultivation gave yields at least equal to cultivation alone. Highest yields resulted where plots were cultivated normally and later hoed. (Contribution from Michigan Agricultural Experiment Station.)

Effect of several herbicides used for control of weedy grasses in growing corn. Finnerty, D. W. Seven chemicals were applied to corn in place of a final cultivation on July 21. Materials were applied in water at 80 gpa. Spray touched only the lower part of the corn stalk. Three replications in a randomized block design were used. Chemicals and rates were: Dow Premerge, 3 and 6 quarts per acre; Carbide and Carbon E.H. #1, 4 pounds; IPC, 3 and 6 pounds; chloro IPC, 3 and 6 pounds; Sodium PCP, 12 and 16 pounds; 2,4-D free acid, 2 pounds; and 2,4-D amine, 2 pounds. Soil was moist, corn and weeds growing actively at time of treatment. Crabgrass and foxtails were in 2-leaf stage between corn rows and 2-leaf to heading in the rows. Observations September 12 showed four of the materials gave an estimated 50% or more control: Dow Premerge, 3 quarts, 50% control; 6 quarts, 60%; Sodium PCP, 16 pounds, 50% control; 2,4-D free acid, 2 pounds, 55%, and 2,4-D amine, 2 pounds, gave 55% control. None of the treatments used appeared to affect the corn, except that corn in plots receiving 6 pounds of either IPC or chloro IPC was 3 to 4 feet shorter than untreated plants. (Contribution of Nebraska Agricultural Experiment Station.)

Reaction of inbreds and hybrid corns to pre-emergence and postemergence spraying with 2,4-D. Josephson, L. M. and Freeman, J. F. Preliminary trials in 1948 with 80 corn inbreds, 8 hyrbids and 12 single crosses showed 9 inbreds to be injured with pre-emergence applications of 2,4-D while 46 inbreds and all of the hybrids showed some type of injury with postemergence spraying. These and all subsequent tests were conducted in a commercial field using the amine salt form of 2,4-D. The soil is a silty clay loam tending toward alkalinity. All plots were kept free of grass-type weeds developing later in the season. In 1949 the 19 inbreds used in hybrids certified in Kentucky were tested both pre-emergence (2 pound rate) and postemergence (0.4 pound rate, corn 8-10 inches high). Only Ky 27 showed any marked reduction in emergence from pre-emergence treatment but several others had a higher percentage of weak plants at emergence. WF9 and Ky 27 were significantly lower yielding in the pre-emergence plots and the average yield of all inbreds sprayed postemergence was significantly lower than in the clean cultivated plots, showing the effects of early weed competition and perhaps some injury. Self-pollinated seed of Ky 27, Kys and K4 from pre-emergence spraying and Ky 122 from postemergence spraying had lower germination than seed with no treatment.
Tests in 1950 were limited to the inbreds and singles comprising Ky 203 since numerous reports of injury and variable results have been obtained with these lines and singles. Pre-emergence rates were 1½ and 3 pounds acid and post-emergence rates were 0.4 and 0.6 pounds of acid applied at the 10-inch and 36-inch stages of growth. No differences in emergence were obtained. The inbreds had more injury when sprayed at the 36-inch height and the singles more injury at the 10-inch stage. More root-lodging occurred in both the inbreds and singles when sprayed 36 inches high at the 0.6 pound rate. Yields have not yet been obtained. The inbreds have been selfed and reciprocal crosses made between the various inbreds and singles for yield testing in 1951 to determine any possible carryover in the seed. (Contribution from the Kentucky Agricultural Experiment Station.)

Response of corn to three formulations of 2,4-D. Lee, Oliver C. and Oyer, E. B. Two series of replicated plots were sprayed with three formulations of 2,4-D: (1) isopropyl ester, (2) polypropylene glycol butyl ether ester, and (3) amine salt. The first series was sprayed on June 29 at which time the corn was approximately 15 inches tall. The second series was sprayed on July 12. Corn at that time was 20 inches tall. All formulations were applied at rates of 1/8, 1/4, 1/2, and 1 pound of acid per acre in 12 gallons of water. Sprays were applied over the top of the corn. Very little effect of the early treatment was noted for a period of approximately two weeks regardless of dosage. Adverse growing conditions prevailed throughout this period. Cool weather and wet soil inhibited plant growth. Corn in the second series of treatments made under more ideal growing conditions showed lodging, and brittleness two and three days after spraying. Very little effect was noted on any of the plots treated with the 1/8 pound rate. Slight lodging, brittleness and distortion of leaves were noted at the 1/4 pound rate. There were no apparent differences between materials at this rate. The 1/2 pound rates caused considerable distortion of corn plants. The differences in response from the three formulations was slight with slightly more distortion of plants on plots treated with the polypropylene glycol butyl ether ester. The amine salt was least injurious. All formulations produced considerable distortion of corn when applied at the 1 pound level. Leaf rolling was more apparent on plots sprayed with the ester formulations than those sprayed with amine salt. Yield determinations will be made. Excellent weed control was obtained with all formulations used when applied at rates of 1/2 and 1 pound of

2,4-D per acre. Rates of 1/8 and 1/4 pounds were not adequate for complete control of weeds. (Contribution of Agricultural Experiment Station, Purdue University.)

Effect of pre-emergence treatments on corn. Lee, Oliver C. and Oyer, E. B. Replicated plots were sprayed to determine tolerance of corn. Five materials were used: isopropyl ester of 2,4-D in rates of 2, 3 and 4 pounds of 2,4-D acid per acre; polypropylene glycol butyl ether ester, rates 1, 2 and 3 pounds per acre; 3,6,-endoxohexahydrophthalic acid (disodium salt), rates 2 and 4 pounds per acre; sodium 2,4-dichlorophenoxy ethyl sulfate, rates 2, 4 and 8 pounds per acre; and dichloral urea, rates 2, 4 and 8 pounds per acre. Corn was planted on June 1, and sprays were applied June 6. First emergence of corn occurred on June 7. The soil, a Brookston silt loam, was moist to wet at time of treating and for several days following. Temperature ranged in the low 80's making conditions favorable for corn growth. Treatments of 1 pound of polypropylene glycol butyl ether ester did not affect the corn. Two pounds caused slight dwarfing and slight reduction in stand, while corn showed considerable injury from 3 pounds. Similar results were obtained with 3 and 4 pound treatments of isopropyl ester. No effects were observed from treatments of 3,6-endoxohexahydrophthalic acid. Sodium 2,4-dichlorophenoxy ethyl sulfate and dichloral urea showed promise of controlling grassy weeds. All rates of these materials caused curling of corn leaves, and in the case of the 4 and 8 pound rates produced stunting of plants and reduced stands. (Contribution of Agricultural Experiment Station, Purdue University.)

Post-emergence herbicides on corn. Meggitt, William F. and C. J. Willard. Two tests, both replicated plots. Mostly 2,4-D formulations at 1/4, 1/2 and 1 pound per acre; also xanthogen disulfide (Sulfasan) at 2½, 5, and 7½ pounds per acre. Corn in one test planted May 24, treated June 13, corn 6 to 8 inches high; and the other planted June 2, treated June 30, 6 to 8 inches high. Xanthogen disulfide only stunted weeds at 5 and 7½ pounds per acre, little effect at 2½. Corn also damaged at higher rates. Definitely not promising. The 2,4-D's ranked about in the following order, both in weed control and damage to corn: butoxy ethanol ester (Weedone LV 4) 1/4 pound good weed control, 1/2 pound excellent weed control, some damage, 1 pound severe damage to corn; polypropylene glycol butyl ether ester (H 1010), entirely similar; a polyethylene glycol ester (ACP 648), an isopropyl ester, and an alkanol amine salt gave similar results in weed control - 1/4 pound not enough, 1/2 pound usually good, 1 pound excellent weed control, some damage to corn, greatest with polyethylene glycol, least with amine. (Contribution of Ohio Agricultural Experiment Station.)

Early heavy postemergence 2,4-D on corn. Meggitt, William F. and C. J. Willard. At the 1949 NCWCC meeting, Stanniforth reported inhibition of tasseling when heavy rates of 2,4-D were applied at the 5-leaf stage. (Pro. 6th An Meeting NCWCC, p. 102-103) This test was planned to explore this report. Ohio C54 corn drilled May 24 in 38" rows, on Miami-Brookston soil, following second year sweetclover. The isopropyl ester of 2,4-D was applied at 0, 1, 2, and 4 pounds per acre. The first plots were treated June 8, when the corn was in the 3-leaf stage, 3 to 4 inches high. Triplicated plots at each rate were treated every alternate day thereafter until the last plots were treated when the corn was in the 7 to 8 leaf stage, 9 to 12 inches high. Corn treated at 6-7 leaf stage (8 to 10 inches) and 7-8 leaf stage was badly lodged and broken when treated with 2 and 4 pounds per acre. Plants treated with 4 pounds at 4-5 leaves (6-8 inches) was excessively lodged and broken. Very little visible damage was noted with any rate when treated at early stages of growth - up to 4 leaves (5-6 inches). When

treated at later stages corn developed very severe onion leaf, brace root damage, and considerable stunting. By maturity most of these effects had been outgrown. There was no inhibition of tassels at any stage with any rate. All tassels developed normally and as nearly as could be determined by observation produced pollen. With very few exceptions all stalks produced ears. Weed control from treatment at stages up to about 4-5 leaves (6-7 inches) was exceedingly good. Much of the grass was controlled in addition to the broadleaf weeds especially at 2 and 4 pounds. Although treatment at later stages gave good control of broadleaf weeds, the grasses had emerged before treatment and consequently were not killed. From appearances, yields will not be greatly reduced in any plot. Yields will be taken. The most important feature of this test is the suggested possibility of using pre-emergence rates for some time after emergence, thus making their application more possible in practice. (Contribution of Ohio Agricultural Experiment Station.)

Pre-emergence herbicides on corn. Meggitt, William F. and C. J. Willard. Two tests: one sown May 23, 4-row plots, triplicated; one, single plots on very weedy but non-uniform soil, as a demonstration. Corn treated 7 days after planting, emerged the next day. Miami-Brookston silt loam soils. These 2,4-D formulations were used at 1, 2, and 4 pounds acid equivalent per acre in the first test, at 1, 1½, and 2 in the other, with the results indicated: butoxy ethanol ester (LV-4) - perhaps the most active formulation, 1 pound gave excellent weed control, 2 and 4 more or less damage; alkanol amine salt, entirely similar to LV-4; polypropylene glycol butyl ether ester (H 1010) also essentially equal to LV-4 in weed control, definitely less damage to corn; isopropyl ester, not quite equal to 3 preceding in weed control, also less damage to corn: same can be said of the polyethylene glycol ester (ACP 648): an emulsifiable form (ACP 638) gave only slightly less weed control and corn damage than the preceding. Xanthogen disulfide (Sulfasan) at 7½, 10, 12½, 15, and 20 pounds per acre gave some mediocre weed control at 10 pounds and up, but was entirely unpromising. No injury to corn. Sodium 3,6-endoxohexahydrophthalate (E.C. 3740) at 1, 2, 4, and 6 pounds per acre gave fair grass control at the two higher rates, with some control of broadleaved weeds No injury to corn. The triethanol amine of DNOSBP used at 5, 7½, and 10 pounds per acre gave good weed control at 10 pounds per acre. MCP (amine) gave good weed control at 2 pounds per acre, the only rate used. Yields not obtained on the larger test, not yet available on the demonstration. (Contribution of Ohio Agricultural Experiment Station.)

Comparison of a low volatile ester of 2,4-D with a standard ester of 2,4-D as a postemergence spray in corn. Slife, F. W. and R. F. Fuelleman. Replicated plots of Ill. 972 were sprayed on two different dates with the isopropyl ester of 2,4-D and the polyethylene glycol half ester of 2,4-D. Rates used were 1/4, 1/2, 1, and 1 1/2 pounds of acid per acre. The height of the corn was 2-3 inches at the first application and 10-12 inches at the second application. The corn showed no damage from the first spraying except at the 1 1/2 pound rate with each chemical. It lodged slightly, grew slower for about 1 week then recovered and appeared normal as compared to the other plots. Weed control was excellent for this first application because it acted as a pre-emergence spray. One-fourth and 1/2 pound rates prevented weeds from emerging for 3 weeks, while 1 and 1 1/2 pound rates were not weedy at the end of the growing season. At the time of the second application, the soil was moist and the corn was growing rapidly. The spray was applied directly over the corn plants. Lodging was severe, particularly on the 1 and 1 1/2 pound plots and much worse with the low volatile ester. There was some lodging with 1/4 pound low volatile ester while there was none with the standard form of 2,4-D at this rate. Weeds had emerged before this application

and it would appear that the low volatile ester was slightly more effective in weed control than was the standard ester although this difference was small. (Contribution of the Illinois Agricultural Experiment Station.)

Chemicals for pre-emergence weed control in corn. Slife, F. W. and R. F. Fuelleman. The following chemicals were applied as a pre-emergence spray to corn; 2,4-D amine, one and two pounds acid per acre MCP amine, one and two pounds acid per acre; ACP 648, one and two pounds acid per acre; ACP 638, one and two pounds acid per acre; ACP 646A, two pounds per acre; EH 1, four and eight pounds per acre; Dow Premerge, 12 quarts per acre; and 3003, four pounds per acre. These chemicals were applied 2 days after planting. This was followed by a small shower which fell the third day after planting. The soil was a black silt loam. Corn emerged on all plots after 6 days without injury except on the Premerge plots which had reduced germination. 3003 did not prevent the emergence of grass or broadleaf weeds and these plots were not distinguishable from the uncultivated checks. 2,4-D, MCP, ACP 648, and ACP 638 at 1 pound per acre and ACP 646A gave good weed control all season except for a few grass weeds emerging later in the season on all these treatments. 2,4-D, MCP, ACP 648, and ACP 638 at 2 pounds per acre gave excellent weed control during the entire season, with the ACP 638 and 2,4-D giving the best results. EH 1 gave excellent results at both 4 and 8 pounds per acre, and these treatments were as effective as the 2 pound rates of 2,4-D and ACP 638.. Dow Premerge gave good weed control, but reduced the germination of the corn. (Contribution of the Illinois A gricultural Experiment Station.)

Pre-emergence weeding in field corn. Staniforth, D. W. and A. L. Bakke. Pre-emergence treatments were made immediately after planting in an area of hybrid corn. Plots consisted of a sprayed strip 3 ft. wide, centered on a 30 ft. drilled row. Guard rows were provided. The field design was a split-plot, randomized block with 4 replicates. Seeding and spraying were done May 17. The soil was dry in the top 1/2 inch, with adequate moisture below. Four days after treatment 1.43 inches of rain fell, and 0.55 inches fell eight days after treatment. Weed counts and other notes were made June 13, at which time the corn was 1 to 1 1/2 ft. tall. Cultivation was done June 14 and June 28. Five formulations of 2,4-D, namely the triethylamine salt, the butyl ester, micronized acid (LFN 472), the acetanalide (ACP 646-A) and the butoxyethanol ester (ACP 683) were used at 0, 1, 2 and 4 pounds per acre, and E.H. #1 and Dow Premerge at 0, 2, 4 and 8 pounds per acre. There were no marked differences in degree of weed control among the 2,4-D formulations. Reduction in weed populations was greatest at 4 pounds per acre for all 2,4-D formulations, but all rates gave adequate control of grassy and broadleaf weeds, when combined with the two cultivations which effectively buried the stunted weeds. Rates of 1 and 2 pounds per acre gave no reduction in yield of corn compared to the cultivated check. At the 4 pound per acre rate the amine salt, LFN 472 and ACP 683 caused a marked reduction in corn yield, while butyl ester and ACP 646-A caused only a slight yield reduction. E.H. #1 at 2 and 4 pounds per acre gave adequate weed control without reducing yields of corn. Dow Premerge gave fair weed control in this test at 8 pounds per acre, and caused no reduction in yield of corn. None of the pre-emergence treatments retarded germination or reduced stands appreciably. (Contribution of Iowa Agricultural Experiment Station.)

Pre-emergence weeding in field corn. Staniforth, D. W. and A. L. Bakke. Pre-emergence treatments were made May 31 within a few hours after seeding on an area of hybrid corn in drilled rows. At the time of treatment the soil was dry on top, but moist below 1/4 inch depth; .83 inches of rain fell two days after treatment. In this test the treated check plots were not cultivated; the guard rows were cultivated twice, which operation destroyed weeds between rows and left a band of uncultivated soil, about 8 inches on each side of the plot rows. Seven formulations of 2,4-D, namely triethylamine salt, butyl ester, micronized acid (LFN 472), acetanalide (ACP 646-A) acetamide of 2,4-D, the 2,4-D acid in oil (ACP 638) and the butoxyethanol ester (ACP 683) were used at 0, 1.2 to 4 pounds per acre. E.H. #1 and Dow Premerge were used at 0, 2, 4, and 8 pounds per acre. Degree of weed control was uniform among 2,4-D formulations, except ACP 646-A and acetamide of 2,4-D which were a little less effective. The higher rates gave the greatest reductions in weed populations and size, and the best season-long control of both grassy and broadleaf weeds. The infestation of grassy weeds was heavy in the check plots, and was markedly reduced by only 1 pound per acre rates. Yields of corn were generally slightly higher than the check plots at all three dosages of 2,4-D. E.H. #1 gave good weed control at 4 and 8 pounds per acre, and a marked reduction in yield of corn at 8 pounds per acre. Dow Premerge gave good weed control and increased corn yield at 8 pounds per acre. (Contribution of Iowa Agricultural Experiment Station.)

Chemical control of weeds in popcorn. Taylor, Clifford E. Illinois Hulless, South American and White Rice popcorn were planted on June 8 on clay loam soil, with pre-emergence treatments applied June 18, emergence June 20-22 and harvest October 1. There were no weeds present at the time of treatment, with the soil surface moist, sunny and the temperature 72-84° F. For the prior week the mean temperature was 71° F. and the rainfall: 6/14 - 0.61" and 6/15 - 3.82". For the next two weeks the mean temperature was 76° F. and the rainfall: 6/21 - 0.03", 6/25 - 0.26", 6/26 - 0.10" and 6/28 - 0.10". Weeds were 97% purslane (Portulaca oleracea) and 3% miscellaneous. Treatments (all per acre, and in 100 gallons water per acre unless otherwise noted) and the percent weed control after 6 weeks for each: xanthogen disulfide at 10 pounds - 77%, Na-PCP at 20 pounds - 100%, NH_4-DNOSBP at 6½ pounds - 100% and Na-2,4-D at 1½ pounds - 74%. Percent control of purslane was 79, 100, 100 and 75%, respectively. The weed control was highly significant with all the treatments. There was no significant effect on the stands and only one significant effect on the yields of popcorn - the yield of White Rice popcorn was very significantly increased by the use of NH_4-DNOSBP. Additional replicated plots were given a postemergence application of Na-2,4-D at 1/2 pound and 1 pound per acre. Applied July 5, 8-9 A.M., with the day sunny, and the temperature 78-85° F. The soil surface and vegetation were dry. The popcorn was about 6" high. There was 0.83" rainfall that night, and apparently as a result there was no weed control and no effects on the popcorn. These postemergence plots were disked on July 30. (Contribution of the Illinois Agricultural Experiment Station.)

Residual effect of sodium TCA on a succeeding corn crop. Watson, A. J. Plots 36 x 50 ft. in two alfalfa-quackgrass sod fields were treated October 24, 1949 with sodium TCA at rates of 25, 50, and 100 pounds acid equivalent per acre. One field is a sandy, well drained soil while the other is a sandy loam soil and less well drained. The TCA was applied to the sod with no previous tillage. Both fields were spring plowed and planted to corn in May 1950. The corn developed normally throughout the season in all treated areas and no symptoms of TCA injury occurred. Only partial control of the quackgrass was obtained. (Contribution from The Dow Chemical Co., South Haven, Michigan.)

Project III. Control of Weeds in Field Crops.

Sorghums — Investigation Leader: W. C. Elder

Summary

Five abstracts were submitted on sorghums from five locations. This crop is late in maturing and many workers did not have time to secure yield data, but have reported observations only. The tests were not uniform. Some investigators were interested in variety response, others in effects of different kinds and rates of 2,4-D and 2,4,5-T on sorghums, but the most uniform tests were on the effect of 2,4-D when used at different stages of growth.

All abstracts were in agreement that 2,4-D affected the root system of sorghums. The brace roots were deformed or enlarged, and when severely injured these roots do not enter the soil. This condition confines all the roots to a small area giving poor anchorage. None of the abstracts reported lodging. Two varieties had some stalk breakage during a rain and wind storm five days after 2,4-D treatment. Two reports referred to the ease of pulling affected plants from the soil as compared with checks.

Ester formulations of 2,4-D appear to be more severe than amine salts on this crop. One investigator found that 2,4,5-T was not as injurious to sorghums as 2,4-D. When more than 1/2 lb. of 2,4-D was used in some of the tests, the plants were dwarfed and late in maturing.

Three abstracts found differential variety response. As has been reported in former years, forage varieties were affected very little under 1 lb. per acre 2,4-D treatments.

Judging from three abstracts it appears that sorghums may be injured at any stage of growth. Two investigators report sterile spikelets when sprayed in bloom. One form of ester at 1 lb. rate completely killed some plants under the four-leaf stage of growth. It seems that sorghums are more susceptible to 2,4-D under the ten-leaf stage of growth than older plants, except in the flowering stage. One test found that varieties respond alike to 2,4-D when treated at the same stages of growth development; however, early and late maturing varieties do not reach this period at the same time.

Project III. Control of Weeds in Field Crops.

Sorghums

Abstracts of Results of Cooperators

The relative response of corn and sorghum to 2,4-D and 2,4,5-T. Barrons, K. C. Two corn inbreds and three sorghum varieties known to vary in their reaction to 2,4-D were treated on two dates with different rates of amine formulations of 2,4-D and 2,4,5-T. The average response of sorghum to 2,4,5-T was far less than to 2,4-D. The difference was very pronounced with Wheatland, a variety known to be highly sensitive to 2,4-D. With corn the difference was less pronounced, however, in some instances there was definitely less malformation of adventitious roots following spraying with 2,4,5-T than with identical rates of 2,4-D. These field plot results confirmed laboratory and greenhouse tests by the writer which indicated less response of corn and sorghum to 2,4,5-T than to 2,4-D. They were also in agreement with the results of corn root activity tests reported by Thompson et al. (Botanical Gazette 107:476-507. 1946). The difference in response of sorghum to the two compounds was sufficient to suggest the desirability of further field tests with 2,4,5-T as a selective herbicide for this crop. (Contribution of the Dow Chemical Company).

Response of an early medium and a late maturing sorghum to treatment with 2,4-D made at 15 different stages of growth, 1950. Hay, James R., Kratochvil, D. E. and Stahler, L. M. Rancher (early), Norghum (medium) and Martin (late) were treated with 3/4 lbs. of ethyl ester of 2,4-D per acre. First treatment was made when plants were 10 to 15 cm high; the second two weeks later at the 6 to 8 leaf stage; the remainder was made at 3 to 4 day intervals until the Martin had headed. The treatments were randomized within solid blocks of each variety with 3 randomized replications of the blocks. Stage of growth was recorded as: (1) height, (2) number of leaves, (3) development of the growing point. Response to treatment was recorded as: (1) root damage, (2) number of tillers per plant (3) grain yield per plant. All varieties showed some root damage; however, their periods of greatest susceptibility occurred at different dates. Rancher showed root injury after treatments from 2 to 5 (third the most); Norghum from 2 to 7 (third and fourth the most); Martin from 3 to 7 (fourth the most). Significantly, fewer tillers were found in Norghum with the first and twelfth treatments and in Rancher with the first and ninth. Yields (grams per plant) were generally lower for the early treatments, particularly the first and those resulting in root damage. No seed was produced in those florets sprayed during pollination. Preliminary data of this investigation indicate that for each variety greatest response of sorghum to 2,4-D occurs when the plants are in similar stages of growth development. The varieties of sorghum used in this experiment did not reach these critical stages of growth development simultaneously. (Contribution of the Agronomy Department, South Dakota Agricultural Experiment Station and U.S.D.A., B.P.I.S.A.E.).

The effect of 2,4-D on sorghum. Phillips, W. M. Amine, isopropyl ester, and polypropylene glycol butyl ether ester formulations of 2,4-D were applied to one forage variety and two grain varieties of sorghum. The rates used were 0, 1/8, 1/4, 1/2 and 1 pound 2,4-D per acre. The two grain varieties, Midland and Westland, were treated at the 4 leaf, 9 leaf (12 to 14 inches) and bloom stages. The forage variety, Ellis, was treated at the 4 leaf and 9 leaf stages. At the time of writing, the grain varieties had not been harvested; therefore, only observations are reported. Plots treated at the first two stages with 1/4 pound or more exhibited characteristic brace root deformation. It was observed that plants which had been treated were less securely anchored than were the untreated plants. Digging and examination of the root system showed evidence of retardation of root development caused by 2,4-D. This was more apparent in the plots treated at the higher rates. Plants on many of the plots treated with 1/2 or 1 pound were several inches shorter than the untreated plots, and in some cases maturity was delayed 5 to 7 days. All three formulations caused the above reactions, but the amine was least damaging followed by the isopropyl ester, and the polypropylene glycol butyl ether ester. There appeared to be little or no difference in the susceptibility of the two grain varieties. The forage variety showed very few symptoms of injury at any time. Forage yields were excellent and there was no indication of damage due to any of the treatments. (Contribution of the Division of Weed Investigations, Bureau of Plant Industry, Soils and Agricultural Engineering, U.S.D.A., Hays, Kansas).

The effect of 2,4-D applied at five stages of growth on four sorghum varieties. Shafer, N. E., Finnerty, D. W. and Webster, O. J. Isopropyl ester, butoxy ethanol ester and the amine salt of 2,4-D were applied at 1/2 and 1 pound in 40 gallons of water at the 4-leaf, 6-leaf, 8-leaf, 10-leaf, and flowering stages on four grain sorghums: Martin, Midland, Nebraska 63, and Westland. Five replications, in a randomized block design, were used. However, yield data and spikelet sterility counts have not yet been analyzed. The following statements are observations only: Notes at time of heading and prior to heading showed that all treatments, except 1/2 pound amine, caused noticeable onion leaf. Stand reduction occurred in some plots receiving 1 pound butoxy ethanol ester at the 4-leaf stage. In general, plants treated at all stages were 2 to 8 inches shorter and 3 to 7 days later in heading than untreated plants. Stunting and delay in heading were most apparent in plants treated at the 10-leaf stage. This could have been because of insufficient time for recovery between this stage and heading. Lodging was not observed in any plots. Observations on plots treated at the flowering stage showed marked spikelet sterility resulting from all treatments. Patches or bands of sterile spikelets clearly indicate the portion of the head which was in flower at time of treatment. Individual heads in three stages of development (late boot, 0 to 50% flowered, 50 to 100% flowered) were tagged in plots receiving the flowering stage treatments. Fertile and sterile spikelet counts are now being taken on these heads. (Contribution of the Nebraska Agricultural Experiment Station and Bureau of Plant Industry, Soils, and Agricultural Engineering, U.S.D.A.).

Response of ten sorghum varieties to 2,4-D treatments. Gassaway, J. E., Davies, Frank F. and Elder, W. C. Grain sorghum varieties of Dwarf kafir 44-14, Redlan, Wheatland, Plainsman, Martin, Westland, Midland, Club x Day, Bonita and Early Hegari were treated with 2,4-D ester at rates of 1/4, 1/2 and 1 lb. per acre. All plots were hand thinned to 3 plants per hill and the hills spaced 30" apart. The spray was applied when the plants were 12 to 15 inches tall, using 40 gallons of water. Growing conditions were favorable throughout the season for this test. All varieties showed characteristic 2,4-D sorghum root damage in proportion to the rate of dosage. However, damage was more noticeable on some varieties. Statistical analyses have not been run on grain yield data. Lower yields were recorded on some varieties at the heavier rates. The Wheatland and Westland varieties were reduced in height from 2 to 5 inches in the 1 lb. per acre plots. Also, a severe rain and windstorm 5 days after spray application caused breakage of stalks in treated plots of these two varieties while other varieties were undamaged. Since the 2,4-D injury reduced grain yields only slightly this year, probably because of good moisture conditions, another study was made to determine the degree of root injury for each variety. The pounds of force necessary to pull the 3-plant hills from the soil were measured. At 1 lb., 1/2 lb., 1/4 lb. and check, the following forces in pounds were recorded for Wheatland: 162, 230, 294 and 344 lbs. respectively. Dwarf kafir, a resistant variety, required 344 lbs. pull at the 1 lb. rate, 354 lbs. at 1/2 lb. rate, 384 lbs. at 1/4 lb. rate and 381 lbs. for the check plots. Pounds recorded for pulling Westland were similar to Wheatland, and the other seven varieties ranked in between the two susceptible varieties and Dwarf kafir. (Contribution of Agronomy Dept., Okla. Experiment Station, Stillwater, Okla.).

Project III. Control of Weeds in Field Crops

Soybeans, peas, and leguminous forage — John H. Miller

Summary

Thirty abstracts were received from 14 different locations indicating the real concern of the workers regarding the response of leguminous crops to herbicides. Nine abstracts were related to the response of seedling stands of small seeded legumes to herbicides; eight with established stands of legumes; eight with pre-emergence treatment of large seeded legumes; four with post emergence treatment of large seeded legumes; and one with herbicides as defoliants for soybeans. From the distribution of reports, an increased interest in herbicides for established stands of legumes is evident. The results from the different cooperators are not entirely in agreement, however more nearly so than in past years.

A. Small seeded legumes.

Seven cooperators reported work on the response to herbicides of seedling legumes in small grain. In general, all of the legumes, except sweet clover, satisfactorily survived concentrations of 1/4 lb. of MCP and the salts of 2,4-D. In many cases survival was satisfactory at 1/2 lb. per acre.

In all comparative trials, Ladino was found to be more tolerant to 2,4-D than other legumes. Alsike and red clover appeared more tolerant than alfalfa. Sweet clover was by far the least tolerant of the legumes studied. Annual lespedeza, while reported by only one station, appears to be quite tolerant to 2,4-D. The amine salt of 2,4-D appeared to injure legumes less severely than the ester formulation. MCP appeared about equal to the amine of 2,4-D. Two workers reported that TCA at 10 lbs. per acre severely damaged red clover and alsike. Ladino was injured but by fall had recovered to a considerable extent. Alfalfa did not appear injured by TCA at this rate. Sweet clover (one report) likewise did not appear damaged.

Single reports were received on the following chemicals. The response of the amine of 2,4,5-T was similar to that of the ester of 2,4-D. Dinitro at 3/4 lb. damaged sweet clover severely, while alsike; red clover, and Ladino were moderately injured. Alfalfa appeared to be quite tolerant. Ladino, alsike, sweet clover, and alfalfa were killed by 10 lbs. of ME 3003. Red clover was somewhat more tolerant.

Five cooperators reported work on herbicides applied to established stands of small seeded legumes. Six abstracts were concerned with alfalfa studies and one abstract was received concerning each of the following legumes: Ladino, alsike, and sweet clover. In all dates of application studies with alfalfa, injury was most severe at the later stages of growth. Alfalfa treated when three inches high or less was not injured by 1/4 lb. of 2,4-D or MCP. Alfalfa seed yields were not reduced by this rate at the early dates. In Wisconsin, applications of 1 lb. per acre of 2,4-D amine did not reduce forage yields of alfalfa when applied at the dormant stage in the spring. Potassium cyanate at 15 and 30 lbs. per acre and monosodium cyanamide at 50, 100 and 150 lbs. did not severely damage alfalfas or control weeds. The dinitros (Sinox and Dow selective) did not injure alfalfa with 6 quarts per acre, while weed control was generally very satisfactory.

Ladino, which was mowed 15 days prior to treatment, was not injured by 1 lb. of the amine of 2,4-D or 1/2 lb. of the amine of MCP. TCA at 5 lbs. per acre did not injure Ladino, at 10 lbs. slight burning occurred but recovery was complete. IPC at 8 lbs. per acre resulted in no damage to Ladino, at 16 lbs. severe burning occurred. Alsike treated at full bloom was not injured by 1/4 lb. of 2,4-D or MCP, or 4 qts. of Dow selective; however, seed yields were materially reduced. In one trial, 2,4-D was used in an attempt to eliminate second year sweet clover. Applications as high as 1 lb. per acre applied at three different dates did not kill all the sweet clover.

B. Large seeded legumes

The primary interest with large seeded legumes was with pre-emergence treatments; as reported by six cooperators. Of this work, eight abstracts were concerned with soybean studies, two with canning peas, and one with field beans. A large number of chemicals were used including seven 2,4-D products; MCP; IPC; xanthogen disulfide; 3,6-endoxohexahydrophthalate; PCP; EH#1; EH#2; two dinitros; polychloro aryl alkyl carbonate; TCA; maleic hydrazide; and granular cyanamid. Only a few of the above chemicals gave good weed control and at the same time produced little or no damage to the legume crop.

The dinitros, which were represented by DN289 and Dow premerge, as a group offered considerable promise for pre-emergence work. The 2,4-D formulations, as a group, gave promise for satisfactory weed control but usually produced at least limited injury to the legume. Contrary to results in previous years, considerable variation between 2,4-D formulations was reported. 3,6-endoxahexohydrophthalate produced erratic results, usually weed control was fair to poor. Xanthogen disulfide, EH#1, and EH#2 offered little promise. IPC and PCP produced erratic results. Information on MCP, maleic hydrazide, and polychloro aryl alkyl carbonate was limited but did not indicate any particular advantage in the use of these materials. Granular cyanamid was reported by one worker to have some possible promise on peas. Peas were found, by one worker, to be slightly more tolerant to TCA than wild oats.

Post emergence work with canning peas and soybeans was reported by four cooperators. Canning pea yields were reduced significantly by 1/8 lb. of 2,4-D and by 1/4 lb. of MCP when treated at the prebloom stage. Tenderometer readings were not effected with applications up to 1/2 lb. per acre. TCA at 8 lbs. per acre did not reduce pea yields, however tenderometer readings exceeded those of the control. Foxtail was reduced significantly. Applications of maleic hydrazide up to 4 lbs. per acre did not reduce pea yields, however 8 lbs. considerably retarded development. IPC used over a range of 2,4, and 8 lbs. per acre significantly reduced pea yields without being effective for weed control. One cooperator reported the use of dinitro (Dow selective) at 1 1/2 and 3 quarts per acre, isopropyl xanthate at 15 lbs. and powdered cyanamid at 100 lbs. Dow selective produced a significant increase in pea yields and gave satisfactory weed control. Isopropyl xanthate caused severe injury to peas. Powdered cyanamid gave poor weed control. Soybeans were injured with as little as 1/8 lb. of 2,4-D. Observations indicate little promise for the use of 2,4-D on emerged soybeans.

One cooperator reported on the use of PCP, dinitros, aero cyanate, and a mixture of sodium chlorate and borax as defoliants on soybeans. All of the materials caused burning of the foliage of both soybeans and weeds. Considerable shrinkage of soybeans occurred when applications were made three weeks before normal maturity.

Abstracts of Results of Cooperators

Small seeded legumes

Effects of herbicides upon legume seedings. Churchill, B. R. and B. H. Grigsby. Data from randomized and replicated plots cover two years, 1949 and 1950. Dinitrophenol and 2,4-D were applied on oats which had been seeded to alfalfa, alsike, Ladino, red and sweet clovers. Preliminary single plot tests with several other chemicals were made in 1950.

Stand counts in 1949 showed that spraying 2,4-D, amine, at 1/2 pound acid equivalent per acre caused considerably more injury than spraying at 1/4 pound per acre. Dinitro at 3/4 lb. per acre and 2,4-D at 1/2 lb. per acre caused more damage at late than at early applications. Sweet clover was the most susceptible legume to both 2,4-D and dinitro. Alfalfa was most tolerant to dinitro while red clover and Ladino were most tolerant to 2,4-D. Hay yields of these plots in 1950 were practically equal to the check except on sweet clover plots sprayed with 2,4-D.

In 1950 no injury was noted on any of the plots from any of the dates or rates of spraying. TCA, at 10 lbs. per acre, gave excellent control of annual grasses but completely killed red and alsike clover. Stands of Ladino clover were injured considerably but estimates in the fall indicated a fair to good stand. Stands of both alfalfa and sweet clover were equal to the check.

Experimental herbicide ME 3003, at 10 lbs. per acre, killed wild buckwheat, ladysthumb, alsike, Ladino, sweet clover and alfalfa. Red clover stands were rated as satisfactory. (Contribution from Michigan Agricultural Experiment Station).

Response to herbicides of legumes sown with oats. Miller, J. H. and Dunham, R. S. Replicated plots of alfalfa, alsike, Ladino, and sweet clover in oats were sprayed with 3/4, 1/2, 1/4 and 0 lbs. per acre of isopropyl ester of 2,4-D, triethanolamine salt of 2,4-D, and triethanolamine salt of MCP. Applications were made, using 25 gallons of spray solution, when the oats were in the following stages: (1) late tiller (6" tall), (2) fully headed (12-14" tall), and (3) after harvest (6" stubble). Legume plant counts were made on permanent quadrats at time of treatment and again in the fall. Statistical examination of these data are not complete thus the conclusions drawn are only tentative. As an average of all treatments, the legume response was as follows: Ladino - no injury; red clover and alsike - slight injury; alfalfa - moderate injury; and sweet clover - severe injury. All legumes, except Ladino, which did not appear injured at any date, were most severely damaged by applications made at the late tiller stage. Little difference could be observed between applications made when the oats were fully headed and after harvest; however weeds had reduced stands considerably before the after harvest treatment was made. Each formulation caused the most injury when applied at the late tiller stage. No difference between applications made when fully headed and after harvest could be observed for the ester of 2,4-D and MCP but the amine of 2,4-D caused more injury when applied at the fully headed stage. For the amine of 2,4-D, survival was greatest with 1/2 lb. applications, indicating 1/4 lb. to be too little to remove the competitive effect of weeds and 3/4 lb. large enough to cause injury. This trend was also true for MCP except with the early application where 1/4 lb. caused the least injury. Alfalfa and alsike appeared least severely injured by MCP. This was particularly true for alfalfa treated at the early date. As an average of all legumes, all dates, and all rates little difference could be observed between formulations. The plots were heavily infested with lambsquarters,

rough pigweed, and common ragweed. These weeds caused about 50% reduction in stands of legumes on the control plots. (Contribution of USDA, Bureau of Plant Industry; and Minn. Agric. Expt. Sta., Div. of Agronomy and Plant Genetics, Paper No. 715, Misc. Jour. Series, Minn. Agric. Expt. Station.)

The influence of volume of herbicide upon legumes in oats. Miller, J. H. and Dunham, R. S. Replicated plots of alfalfa, red clover, and sweet clover in oats were sprayed with 3/4, 1/2, and 1/4 pound of isopropyl ester of 2,4-D, triethanolamine salt of 2,4-D, and triethanolamine salt of MCP using two volumes of spray solution; i.e. 25 and 40 gallons per acre. Applications were made when the oats were in late tiller (6" tall), and when the oats were fully headed (12-14" tall). Legume counts on permanent quadrats were made at time of treatment and again in the fall. The plots were heavily infested with lambsquarters, rough pigweed, and common ragweed. Considerable wild buckwheat and some cocklebur and smartweed were also present. Statistical examination of these data are not complete thus the conclusions drawn are only tentative. A satisfactory control of all weeds was obtained, except wild buckwheat and smartweed. As an average of all dates, all formulations, all rates, and all legumes, the 25 gallon volume appeared slightly more damaging to the legumes than the 40 gallon applications. Alfalfa appeared more severely injured by the smaller volume than the other two legumes. Little difference could be observed between volumes for either red clover or sweet clover. No difference between volumes could be observed at the heading date; however at the late tiller date survival was decreased by about 15% using the lower volume. Survival was greater for each of the formulations when the 40 gallon volume was used. This likewise was true for each of the rates except when the 1/4 lb. applications as an ester of 2,4-D was used. (Contribution of USDA, Bureau of Plant Industry and Minnesota Agric. Expt. Sta., Div. of Agronomy and Plant Genetics. Paper No. 716, Misc. Jour. Series, Minn. Agric. Expt. Station.)

Red clover stands following 2,4-D applications to seedlings in oats. Buchholtz, K. P. Medium red clover was seeded at 12 lbs. per acre on May 22, 1950 immediately after Mindo oats had been planted at 1 1/2 bus. per acre. Excellent stands of red clover were obtained. On June 29 plots 6 by 12 feet in size were sprayed with sodium salt, amine and isopropyl ester preparations of 2,4-D at rates of 0.25, 0.5 and 1.0 lbs. per acre. On this date the oats were about 20 inches high and in the boot stage but had not headed while the clover was from 4 to 6 inches high. Four replicates were used. Rainfall was abundant throughout the season. The grain was removed on August 10. On September 23 clover plants were counted in 3 two sq. foot quadrats on each plot. Check plots averaged 21.0 plants per sq. foot. None of the plant counts on plots treated with sodium salt or amine preparations of 2,4-D differed significantly from check. Counts on plots treated with the ester preparation were 99, 64 and 39 per cent of check for the 0.25, 0.50 and 1.0 lb. applications. The two latter applications caused highly significant reductions in stand. The ester preparation of 2,4-D was shown to be significantly more toxic to red clover than the sodium or amine salts. The data indicates that good stands of red clover can often be obtained even though heavy applications of 2,4-D are made. It appears probable that the shielding due to grain growth at the date of application and the abundant moisture supply during the season contributed to the favorable results observed in this trial. (Department of Agronomy, University of Wisconsin, Madison, Wisconsin.)

The relative tolerance of seedlings of four forage legumes to Sodium TCA. Barrons, K. C. Grimm Alfalfa, medium red clover, alsike clover and Ladino clover were sprayed in the unifolate stage with 10 lbs. per acre of sodium TCA 90%. (7.9 lb. acid equivalent) The stand of red clover and alsike clover was completely eliminated. Growth of Ladino clover was retarded but it recovered. Alfalfa showed little effect. Seedlings of foxtail, crabgrass and old-witch grass were killed or prevented from emerging.

The test was repeated at 10 lbs. and 20 lbs. per acre of sodium TCA 90% (7.9 lbs. and 15.8 lbs. acid equivalent) when the legume seedlings had four to eight trifoliate leaves. Red clover and alsike clover were killed by the 20 lb. rate and severely injured by 10 lbs. Ladino clover showed slight growth retardation at 10 lbs. and more growth retardation at 20 lbs., however recovery was complete in each instance. Alfalfa showed no effect from the 10 lb. rate and slight growth supression from 20 lbs. Foxtail, crabgrass and old-witch grass were killed or stunted.

The results of these experiments suggest the desirability of further tests with sodium TCA 90% on new seedlings of Ladino clover and alfalfa wherever this herbicide might aid in obtaining weed-free stands.

One half of each legume block in the above test was interplanted to oats and both the interplanted and the pure seedings were sprayed on both dates. In no instance did 10 pounds of sodium TCA 90% appear to hurt the oats and the 20 pound rate had only a slight effect. The tolerance of oats to this herbicide appears adequate to suggest further tests on the TCA treatment of companion crops of oats and alfalfa, or oats and Ladino clover.

Stands of clover and alfalfa in wheat and oats treated with 2,4-D at several dates and rates. Bernard, R. L., and Willard, C. J. A clover-alfalfa mixture was sown in the wheat and oats. Alfalfa failed in the wheat even in the checks. In the oats alfalfa was definitely more injured by 2,4-D than red clover but some alfalfa survived wherever clover did. Although injury was practically always manifest, and many individual plots failed, satisfactory stands of red clover frequently survived 1/4 and 1/2 pound per acre of 2,4-D (isopropyl ester) in oats and in wheat (amine salt). A few plants, but not satisfactory stands, survived heavier rates. The hazard of loss is always present, so treating small grain undersown with legumes cannot be recommended except as in an emergency by taking precautions, one might still have a red clover stand after treating with 2,4-D. (Contribution of the Ohio Agricultural Experiment Station.)

Treatment of sweetclover underseeded in oats with 2,4,5-T and three formulations of 2,4-D, Scotland, South Dakota 1949-1950. Kratochvil, D. E., Hay, James, Derscheid, L. A., and Stahler, L. M. Butyl ester of 2,4-D, triethanolamine salt of 2,4-D and the amine salt of 2,4,5-T were applied to sweetclover underseeded in oats at two dates at 1/4 and 1/2 lbs. per acre. Also included were the sodium salt of 2,4-D at 1/2 pound per acre. Three randomized replications of 1 x 8 rod plots were used. First treatment was applied June 9, 1949 - oats pre-heading; sweet clover 6 inches tall: second treatment June 21, 1949 - oats headed; sweet clover 18 inches tall. Ten gallons of solution per acre was applied with a power sprayer. Stand counts were taken in the fall of 1949. First date-ester of 2,4-D 1/4 lb. - 17% survival, 1/2 lb. - 1%; amine of 2,4-D 1/4 lb. - 77%, 1/2 lb. - 10%; amine of 2,4,5-T 1/4 lb. - 8%, 1/2 lb. - 0.2%. Second date-ester of 2,4-D 1/4 lb. - 2%, 1/2 lb. - .2% amine of 2,4-D 1/4 lb. - 47%, 1/2 lb. - 14%; amine 2,4,5-T 1/4 lb. - 3%, 1/2 lb. - 5%; Na salt 1/2 lb. - 28%. Hay yields taken in the spring

of 1950 showed corresponding results. For practical purposes the most satisfactory stand of sweet clover was obtained after spraying with 1/4 lb. of amine at either date. (Agronomy Department of the South Dakota Agricultural Experiment Station and Bureau of Plant Industry, Soils and Agricultural Engineering, U.S.D.A.)

Control of weeds in lespedeza with 2,4-D. Elder, W. C. Plots, 16.5' x 16.5', were laid out in an early Korean lespedeza pasture. Amine formulation of 2,4-D was used at rates of 1/4, 1/2 and 1 lb. of acid per acre. The first application was made June 17 when the lespedeza was 4" to 6" high and several species of weeds were the same size. The same application was made again on July 12 at pre-bloom stage of growth for the lespedeza; however, the weeds were large, standing above the legume. The principal weeds present were Western ragweed (Ambrosia psilostachya), marestail (Erigeron canadensis), and Heterotheca subaxillaris. Forage yields were taken when lespedeza was in full bloom. Treatments made on June 17 killed the weeds better and damaged the lespedeza less than the treatments made July 13. The weeds that had reached the advanced stage of growth were more resistant to 2,4-D and the leaves of the lespedeza that were killed were not replaced by new growth. Check plots produced approximately 2,000 lbs. of dry lespedeza forage and 1,500 lbs. of weeds per acre. The 1/2 lb. of 2,4-D per acre eliminated most of the weeds for the early treatment, while the 1 lb. rate completely eradicated all weeds. Forage yields increased from 2,000 lbs. up to 3,000 lbs. per acre, and the weed decrease from 1,500 lbs. down to 600 lbs. per acre for the 1/2 lb. rate, and to a trace of weeds for the 1 lb. rate. Seed yields followed much the same pattern as forage yields. The practical application of this test is the possibility of eradication of perennial ragweeds in native grass pastures that have been planted to lespedeza. (Contribution of Agronomy Department, College of Agriculture, Stillwater, Oklahoma.)

Effect of 2,4-D on annual lespedeza when used at 6 stages of growth. Elder, W. C. Three leading strains of annual lespedeza were planted in 1 ft. rows. The two center rows of a 4-row plot were treated. One-fourth, 1/2 and 1 lb. acid of amine formulation of 2,4-D were used per acre in the test. The first application was made on young plants less than 1" high. Five other applications were made at 18-day intervals thereafter. This extended the treatments from emergence to bloom period. All strains reacted alike when sprayed at the same stage of growth. Most of the young lespedeza was killed with 1/2 and 1 lb. per acre at the first spraying. Lespedeza was 2" to 3" high at the second treatment and only a small decrease in growth was caused by the 1/2 lb. rate. In the third and fourth treatments, after the plant had reached 4" height, the 1/4 and 1/2 lb. rates did not affect forage yields. After the plant reached full growth, slight damage occurred from 1/2 lb. rates and severe damage occurred in the early bloom or sixth stage of growth. Damage from the 1/4 lb. rate only showed up in the first and sixth stages of growth. One-pound rates decreased yield 50% for the sixth treatment. However, 1 lb. lowered yields only slightly for the fourth stage, when the lespedeza was 6" to 8" high and growing rapidly. One-half and one-pound rates of 2,4-D caused yellow leaves to appear and many were dropped. However, new leaves soon appeared on large, fast growing plants. After the plant was mature and then treated, new leaves did not appear. The year 1950 was an exceptionally good year for lespedeza growth and possibly had much to do with re-growth of new leaves. Seed yields are to be taken for the test. (Contribution of Agronomy Department, College of Agriculture, Stillwater, Oklahoma.)

The effect of Chemicals on Legume Crops. Leggett, H. W. The following 3 tests were carried out: (1) On 2nd year alfalfa (2) On 2nd year alsike clover (3) On seedling alfalfa in Olli barley. The chemicals used were agroxone (sodium salt), methoxone (butyl ester), triethanolamine salt of 2,4-D, ethyl ester of 2,4-D and Dow Selective. All chemicals, with the exception of Dow Selective, were used at rates of 2 and 4 oz. of acid per acre. Dow Selective was applied at the rate of 1 gal. in 100 gal. of water per acre. The results on the 2nd year alfalfa look promising. All the chemicals except Dow Selective affected the topgrowth of the alfalfa, which was in the pre-bud stage, to a greater or lesser degree. The ester and amine at both rates damaged the topgrowth the worst, followed by the methoxone and then the agroxone. There is a certain percentage of regrowth appearing on all plots, with Dow Selective being the best, followed by methoxone, agroxone, ethyl ester and triethanolamine formulations. None of the plots were completely devoid of regrowth, the percentage of regrowth ranging from 34.2 to 96.7%. In some of the plots the regrowth did not have a healthy appearance. Readings on these plots in the spring should give the final story. The results on 2nd year alsike clover treated in the full bloom stage showed 100% regrowth on all plots. The seed yields of the plots were significantly affected by all treatments, but to a lesser extent by Dow Selective and methoxone at the 2 oz. rate. The results on seedling alfalfa in Olli barley appear promising, although complete results will not be known until next year. The ethyl ester and triethanolamine plots at 4 oz. completely eliminated all the alfalfa but at the 2 oz. rate approximately 25% was showing regrowth from the seedling crowns. Methoxone at 4 oz. seriously damaged 65% while at 2 oz. only 30% of the seedlings were affected. Agroxone at 4 oz. damaged 35% and at 2 oz. only 15%. Dow Selective damaged only 8% of the seedlings. The weeds in these plots were in the seedling stage, and were completely killed in all plots except those treated with Dows Selective. (Contribution of the Dominion Experimental Station, Lacombe, Alberta.)

Effect of 2,4-D applications on yields from established alfalfa stands. Buchholtz, K. P. Plots 4 by 12 feet in size in a three year old stand of Grimm alfalfa were treated with an amine preparation of 2,4-D at rates of 0.125, 0.25, 0.5 and 1.0 lbs. per acre. Applications were made at a dormant stage prior to spring growth on April 20, on May 11 when 3 inches high, on May 23 when 6 inches high, and on June 7 when 12 inches high. The plots were harvested on June 19. Four replicates were used and spray applications were made at a rate equivalent to 40 gallons per acre. Applications made on April 20 had no significant effect on yield and caused no minor formative effects. At the 3 inch stage yields of plots treated with 0.125 and 0.25 lbs. of 2,4-D were 1.43 and 1.45 tons per acre and compared favorably with check which yielded 1.39 tons. Marked formative effects were noted following these treatments but later growth was affected only slightly. Yields from plots treated at the 0.5 and 1.0 lb. rates was severely affected being 0.97 and 0.37 tons per acre respectively. Applications made at 6 inch stage were particularly toxic with the 0.125, 0.25, 0.5 and 1.0 lb. applications giving yields of 1.17, 1.06, 0.33 and 0.12 tons per acre respectively. Yield reductions were not great for applications made on June 7 being 1.50, 1.32, 1.02 and 1.42 for the four rates of application. Alfalfa growth was severely affected by these latter treatments, however, and many plants appeared to be killed. Weeds susceptible to 2,4-D and present in alfalfa fields during early spring dormancy or early growth periods might be controlled by proper use of 2,4-D without significant injury to the alfalfa. (Department of Agronomy, University of Wisconsin, Madison, Wisconsin.)

Effect of methoxone on alfalfa seed fields. Alex, J. F., Coupland, R. T., Bolton, J. L., and White, W. J. Methoxone sodium salt at 3, 6, 9, 12 and 15 oz. of acid per acre and methoxone n-butyl ester at 2, 4, 6, 8, and 10 oz. of acid per acre were applied to an 11-year old stand of Grimm alfalfa in two stages of development. Stage 1, on May 26 when the height of alfalfa was 3 inches and of weeds (Axyris amaranthoides and Chenopodium album) was 1 to 2 inches; stage 2, on June 24 when the respective heights were 18 inches (alfalfa), 3-6 inches (Axyris), and 4 inches (Chenopodium). Application was made to duplicated plots by a hand-powered wheel sprayer delivering 7.1 gallons per acre. Butyl ester in the May treatment resulted in no reduction in weeds at 2 oz., 35% reduction at 4 and 6 oz. and 75 to 100% reduction at 8 and 10 oz. rates. Control by the sodium salt at this stage was 10, 25, 35, 85 and 10%, respectively, with treatments of 3, 6, 9, 12 and 15 oz. In the second stage weeds were completely removed by all treatments except sodium salt at 3 oz. which reduced the stand by 75%. No damage to alfalfa plants resulted from the first stage of treatment, except with butyl ester at 8 and 10 oz. in which case recovery was complete by September. The second treatment (June) caused severe damage at all rates and recovery was not made by September except at the lowest rate of each chemical. At the first stage (May) 2 oz. of butyl ester and 3 and 6 oz. of sodium salt had little or no detrimental effect on seed yield of alfalfa and 12 and 15 oz. of sodium salt reduced the yield about 25%, while 4, 6, 8, and 10 oz. of butyl ester reduced it by 50% or more. The June treatment eliminated seed production at all rates above the lowest rate of each chemical. The 2 oz. butyl ester plots produced a few seeds, the 3 oz. sodium salt plots produced about 30% of the checks. Sodium salt at 9 to 12 oz. per acre in an intermediate stage may have been less damaging to alfalfa and more effective on weeds. It seems more promising than butyl ester of methoxone and is comparable to 2,4-D amine. (Contribution of the Department of Plant Ecology, University of Saskatchewan and the Dominion Forage Crops Laboratory, Saskatoon.)

Effect of potassium cyanate and monosodium cyanamide on alfalfa seed fields. Alex, J. F., Bolton, J. L., Coupland, R. T., and White, W. J. Potassium cyanate at 15 and 30 pounds per acre and 41.5% monosodium cyanamide x 5 at 50, 100 and 150 pounds per acre were applied to an 11-year old stand of alfalfa at Nipawin, Saskatchewan, at two stages of development. Stage 1, on May 26 when alfalfa was 3 inches high and the weeds (Axyris amaranthoides and Chenopodium album) were 1 to 2 inches; stage 2 on June 24 when height of alfalfa was 18 inches, Axyris-3 to 6 inches and Chenopodium was 4 inches. The chemicals were applied to duplicate plots with a knapsack sprayer in 100 gallons of solution in the May treatment and 74 gallons of solution per acre in June. Neither treatment was effective in appreciably reducing stand of weeds. No damage to alfalfa plants occurred from the first treatment. Slight damage occurred from the second treatment of both chemicals at the lowest rates, slightly heavier damage resulted from monosodium cyanamide at 100 and 150 pounds and moderate damage resulted from the 30-pound rate of potassium cyanate. Recovery was complete by September in all plots except the 30-pound rate of potassium cyanate and here it was well advanced. Except for a 20% reduction at 150 pounds of monosodium cyanamide, the May treatments had no effect on alfalfa seed production. The June treatment of potassium cyanate had no effect on seed yield, while monosodium cyanamide at 50 and 100 pounds reduced it to about two-thirds of the check and the 150 pound rate to one-third that of the check plots. These chemicals may be useful in controlling susceptible weeds in alfalfa but were of little use with the weeds present. (Contribution of the Department of Plant Ecology, University of Saskatchewan and the Dominion Forage Crops Laboratory, Saskatoon.)

Effect of 2,4-D on alfalfa seed fields. Alex, J. F., Bolton, J. L., Coupland, R. T. and White, W. J. 2,4-D ester (butyl), 2,4-D amine (a mixture) were applied to an 11-year old field of Grimm alfalfa at Nipawin, Saskatchewan at two stages of development. Stage 1 on May 26 when alfalfa was 3 inches high and the weeds, Axyris amaranthoides and Chenopodium album, were 1 to 2 inches. Stage 2, on June 24 when height of alfalfa was 18 inches, Chenopodium 4 inches, and Axyris 3 to 6 inches. The chemicals were applied with a hand-powered sprayer in 7.1 gallons of solution per acre to duplicate plots of 1/70 acre. In the first stage both formulations at 2, 4, 6, 8, 10 and 12 oz. per acre were relatively ineffective in sustained weed control, only 25% of the weeds being killed by the heaviest rates. At the second stage 2,4-D amine only was used. 2, 3, 4, and 5 oz. per acre gave about 25, 50, 100 and 100 per cent reduction in stand of weeds, respectively. All rates of treatment had an effect on alfalfa but all plots were again growing vigorously by September, except for possible damage by the ester at 6 to 12 oz. in the first stage. Amine at 2 and 4 oz. and ester at 2 oz. in the first stage did not reduce seed yield of alfalfa. 6 and 8 oz. rates of amine in May caused a 25% reduction; 10 and 12 oz. of amine and 4 to 12 oz. of ester in the first stage and 2 oz. of amine in the second stage reduced seed set by 50% or more; 3, 4, and 5 oz. of amine in the second stage eliminated seed production. The effective treatments from the standpoint of weed control resulted in excessive damage to seed production at the times used. (Contribution of the Department of Plant Ecology, University of Saskatchewan and the Dominion Forage Crops Laboratory, Saskatoon.)

Effect of dinitros on alfalfa seed fields. Alex, J. F., Coupland, R. T., Bolton, J. L., and White, W. J. Sodium dinitro ortho cresylate 30% (Sinox) and ammonium dinitro-sec-butylphenate 13.7% (Dow Selective Weed Killer) were applied to an 11-year old stand of Grimm alfalfa at Nipawin, Saskatchewan on June 24 when the alfalfa was 18 inches in height. Principal weeds were Axyris amaranthoides (3 to 6 inches) and Chenopodium album (4 inches). Sinox was applied to duplicated plots at 2, 4, and 8 qts. per acre and Dow Selective Weed Killer at 2.2, 4.4, and 6.6 qts. per acre. A knapsack sprayer delivering 74 gallons of solution per acre was used. Sinox at the rates applied and the lowest rate of Dow Selective had little or no effect on weeds. Weeds were reduced 75% by Dow Selective at the 4.4 qt. rate and 100% at the 6.6 qt. rate. The treatments had only slight effect on the alfalfa stand and recovery was complete by September. Reduction in seed yield was slight at the highest rate of Dow Selective but was otherwise insignificant. These results indicate that control of certain weeds in alfalfa by dinitro compounds is feasible. (Contribution of the Department of Plant Ecology, University of Saskatchewan and the Dominion Forage Crops Laboratory, Saskatoon.)

The effect of certain weed chemicals on Ladino clover. Slife, F. W., and Fuelleman, R. F. MCP, 2,4-D, TCA, and IPC were applied to second year Ladino clover on May 25, August 15, and October 10. Each series of treatments were mowed every 15 days prior to treatment to simulate grazing. The amine formulation of both MCP and 2,4-D was applied at 1/4, 1/2, 1, and 2 pounds of acid per acre. It would appear from these preliminary tests that Ladino is rather resistant to 2,4-D. It was not affected by 1/4 pound applications; 1/2 pound caused twisting and curling of the stems but it recovered completely within 2 weeks, 1 pound caused severe twisting of the top growth but no reduction in stand and it appeared normal within 1 month, and 2 pounds caused severe twisting of the stems, some dying of the leaves, and a slight reduction in stand of plants. Plots receiving 2 pounds of 2,4-D, although severely stunted for 2 months, began to grow after that time and new plants

from the stolons soon covered the entire plots. By late fall these plots could not be distinguished from the check areas. MCP was similar to 2,4-D in its mode of action on Ladino but was much more severe. In general MCP seemed to be about twice as effective as 2,4-D on Ladino in that 1/4 pound produced the same effects as 1/2 pound of 2,4-D, etc. MCP at 2 pounds eliminated 90 per cent of the Ladino and in late September there was little or no regrowth on these plots. TCA had no effect on Ladino at 5 pounds per acre but 10 pounds caused a slight burning on the edge of the leaves. IPC with an oil base caused no injury to Ladino at 8 pounds per acre, but 16 pounds per acre caused severe burning of the leaves due to the oil carrier. (Contribution of the Illinois Agricultural Experiment Station, Urbana, Illinois.)

2,4-D on sweet clover. Willard, C. J., and Bernard, R. L. Plowing sweet clover in late fall or early spring has always been followed by serious resprouting - enough to make impossible following sweet clover green manure with wheat, oats, sugar beets, or similar early-sown crops. Brewbaker of Great Western Sugar Co., suggested 2,4-D. This experiment was to explore the possibilities. An excellent first-year stand of Evergreen sweet clover was treated November 11, March 17, and April 7 with an amine salt of 2,4-D at 1/8, 1/4, 1/2, 3/4 and 1 pound per acre. Plots were 7' x 50', triplicated.

Surprisingly, not even 1 pound killed all sweet clover at any date. One date appeared about as effective as another, and there was little apparent difference in rates, especially of 1/2 pound and above.

Unfortunately, none of the plots were plowed until May, when there is no trouble with resprouting. From the appearance, there would have been no recovery after plowing of any plot treated with 1/2 pound or more, but this should be verified. (Contribution of Ohio Agr. Exp. Station.)

Large seeded legumes

Pre-emergence weed control in soybeans. Slife, F. W., McKibben, G. E. and Fuelleman, R. F. Duplicate plots of Hawkeye soybeans were sprayed just prior to emergence with IPC at 8 and 16 pounds per acre, 2,4-D amine--one and two pounds per acre, Dow Premerge--12 quarts per acre, ACP 638--one and two pounds per acre, ACP 648--one and two pounds per acre, 3003 at 4 pounds per acre, and maleic hydrazide at 8 pounds per acre. IPC, maleic hydrazide, and 3003 had no effect on the beans and were not effective as a pre-emergence treatment. ACP 648, ACP 638, and 2,4-D at 2 pounds per acre gave excellent weed control but reduced the emergence of the beans slightly. The beans on these plots were less vigorous in the early stages of growth than were the beans on the check plots. ACP 648, ACP 638, and 2,4-D at 1 pound per acre gave good weed control for 4 weeks but reduced the vigor of the soybeans slightly. 2,4-D amine seemed less injurious to the soybeans than ACP 648 or ACP 638. Dow Premerge gave excellent weed control, but at 12 quarts per acre severely reduced the emergence of the soybeans. The soil was a brown silt loam. (Contribution of the Illinois Agricultural Experiment Station, Urbana, Illinois.)

Effect of time of treatment on pre-emergence weeding in soybeans. Staniforth D. W. and Bakke, A. L. In this test, the pre-emergence treatments were made immediately after seeding on one set of plots, and just at the time the beans were emerging on another set. The beans were seeded June 8, and dates of treatment were

June 8, and June 13. Rainfall during the period was 2.48 inches on June 9, .35 inches on June 12 and 2.67 inches on June 18. Treatments at each date were E.H.#1 at 2, 4 and 8 lb/A., butyl ester of 2,4-D at 1, 2 and 3 lb./A., acetamide of 2,4-D at 1, 2 and 3 lb./A. and Dow Premerge at 3 and 6 lb./A. With the treatment at the time of seeding, weed populations were reduced 40 - 75%, by all the treatments. The poorest control was obtained with the lowest rates of all chemicals and the best with the highest rates. The treatments made just before emergence gave generally better weed control, although the differences were not marked except for E.H.#1 at 8 lb./A., the acetamide of 2,4-D at 2 and 3 lb./A. and Dow Premerge at 6 lb./A. Injury to the soybeans and reductions in yield were severe for E.H.#1 with first date treatments, but second date treatments did not reduce yields below the check even at 8 lb./A. The butyl ester caused more injury to yield reduction at the first date of treatment, with the difference greater at higher dosage. The acetamide caused less injury with the first date of treatment, with the difference greater at the higher rates. Dow Premerge caused only slight injury and no significant yield reduction with first date at 6 lb/A. (Iowa Agricultural Experiment Station.)

Pre-emergence weeding in late sown soybeans. Staniforth, D. W., and Bakke, A. L. Soybeans were seeded June 8 and the pre-emergence treatments were made later on the same day. The soil was dry on top but moist below 1/4 inch at the time of seeding. Rainfall during the night of June 8 and on June 9 amounted to 2.48 inches. Six formulations of 2,4-D were applied at 1 to 2 lb./A., E.H.#1 at 2 and 4 lb./A. and Dow Premerge at 3 and 6 lb./A. The amine salt, butyl ester, micronized acid, acetanalide and acetamide of 2,4-D gave good control of grassy to broadleaf weeds at 2 lb./A. The 1 lb. per acre rate of these formulations showed almost as good weed control. E.H.#1 gave very good control at 2 lbs. and 4 lbs. with little difference between the two rates. Dow Premerge gave good weed control at both rates. The dioctodecyl amine salt of 2,4-D gave practically to weed control at 1 and 2 lb./A. All the treatments with 2,4-D and E.H.#1 caused some stunting of soybeans and formative effects on the leaves. This injury was most severe at the heavier rates. Among the formulations of 2,4-D, the amine, ester and micronized acid were most injurious, and the acetanalide and dioctodecyl amine the least injurious. Dow Premerge did not injure the beans and caused no yield reductions. E.H.#1 caused a 40% yield reduction at 4 lb. and 20% at 2 lb./A. The acetanalide of 2,4-D (ACP 646-A) and dioctadecylamine of 2,4-D gave no yield reduction at either rate. All other formulations caused significant yield reductions at 2 lb./A. at 1 lb./A. the reduction was less marked. (Iowa Agricultural Experiment Station.)

Pre-emergence weeding in early sown soybeans. Staniforth, D. W., Bakke, A. L., and Weber, C. R. The soybean variety Hawkeye was seeded 1 1/2 inches deep on May 12, and the pre-emergence herbicidal treatments were made later in the same day. A plot consisted of a 3 ft. band of treated soil centered over a 20 ft. row of beans. The field design was a split-plot, randomized block, with four replicates. The soil was dry on top, but moist below 1/2 inch at the time of seeding. Rainfall during the 8 day interval between seeding and emergence was .25 inch, one day and four days after seeding. An additional 1.43 inches of rain occurred one day after emergence. Seven formulations of 2,4-D, triethylamine, butyl ester, micronized acid (LFN 472), 2,4-D in oil (ACP 571), butoxyethanol ester (ACP 683), and the acetanalide (ACP 646-A) were applied at 1 and 2 lb./A. All the formulations of 2,4-D reduced stands of grassy and broad-leaved weeds by approximately 50% at the 1 lb./A. rate and by 75-80% at the 2 lb./A. rate of treatment. The predominant weed species were foxtail, smartweed and lambsquarters. After weed counts were made, the plots were mechanically cultivated during the rest of the season. E.H.#1 at 2 and 4 lb./A. and

and Dow Premerge at 3 and 6 lb./A. showed weed control comparable to that of the 2,4-D formulations. E. C. 3740 gave very little weed control and no effect on the beans in this test. The soybeans exhibited no visible signs of injury beyond a few formative effects on the earlier trifoliate leaves. The yields of beans were not reduced by any of the 2,4-D treatments. E.H.#1 reduced yields at both rates of treatment. Dow Premerge treatments showed a moderate yield increase over the check plots in this test. (Iowa Agricultural Experiment Station.)

Effect of pre-emergence treatments on soybeans. Lee, Oliver C. and Oyer, E. B. Pre-emergence treatment on Lincoln soybeans was made on June 10, five days after the beans were planted. At this time, 50 per cent of the plants had emerged to the cotyledon stage. Chemicals used included: (a) isopropyl ester of 2,4-D at 1.5, 2, and 2.5 lbs./A.; (b) polypropylene glycol butyl ether ester of 2,4-D at 1, 1.5 and 2 lbs./A.; (c) 3,6-endoxohexahydrothalic acid (formerly E.C. 3740) at 2 and 4 lbs./A.; (d) dinitro-o-sec-butylphenol at 4, 6 and 8 lbs./A.; and (e) polychloro aryl alkyl carbonate (Goodrite 3947) at 4 gal./A. Water was used as a diluent, and the solution was applied at the rate of 12 gal./A. Plots were replicated four times. The Brookston silt loam in which the beans were growing was very moist at time of treatment. Moist soil conditions prevailed after the treatment, as measurable precipitation was recorded for 8 of the 9 days immediately following the day of treatment. Visual observations were made on June 28 when beans were 4-6 inches high. All rates and formulations of 2,4-D caused some stand reduction, dwarfing of plants, and distorting of stems and leaves. No harmful effects to the plants were noticed at the 2 lb./A. rate of 3,6-endoxohexahydrothalic acid; slight cotyledon burn was the only injury observed at the 4 lb. rate. TheDNOSBP had no markedly harmful effects on the plants at the 4 lb. rate and only slight injury in the form of distortion of leaves and stems at 6 lbs. The 8 lb. rate caused stand reduction and dwarfing of plants. The Goodrite 3947 gave injury symptoms similar to 2,4-D. Observations made on September 15 when control plants were nearing maturity showed that plants treated with both formulations of 2,4-D at all rates were retarded in their maturity, and plants treated at high rates were dwarfed. All plants treated with 3,6-endoxohexahydrothalic acid appeared normal. Slight dwarfing and delayed maturity was evident on plants treated with DNOSBP at 8 lbs./A., while 4 and 6 lb. treatments apparently had no lasting effect on beans. Plants treated with Goodrite 3947 appeared normal. Area was not sufficiently weedy to give check on weed control. No yield checks were made. (Contribution of Agricultural Experiment Station, Purdue University.)

Pre-emergence herbicides on soybeans. Meggitt, W. F., and Willard, C. J. Four tests: Sown May 3, treated May 4; sown May 3, treated May 10; sown June 10, treated June 13; sown Aug.23, treated Aug.26. Hawkeye soybeans were drilled solid in plots 6' x 24', with a mixture of 1 part rape and 2 parts German millet broadcast when sowing the Soybeans, triplicated: each rate, each chemical, each test, 450 plots besides 1 check for each 4 plots in first three series, for each two in the last. Rain followed the May 4 treatments; soil was wet on May 10, beans emerged May 1 ; soil moist June 13, no rain until after emergence; soil barely moist Aug.23, only a slight shower before emergence. The chemicals used and notes on results follow. All rates are based on the active ingredient.

Dinitro-o-sec-butyl phenol. triethanolamine salt, (DN 289) was, as last year, the most generally satisfactory chemical used. Rates of 2½ 5. 7½ and 10 lb./A. were used - little damage to beans even at highest rate (some to roots), and good weed control at 7½ and 10 lb. Best practical rate 7½ lb. - in wet weather even this can cause severe damage. 2,4-D as an alkanol amine salt (Dow Form. 40), an isopropyl

ester (Esteron 44) a wettable 2,4-D acid (LFN 472), a water-emulsfiable 2,4-D (ACP 638), a polyethylene glycol ester of 2,4-D (ACP 648), and a polypropylene glycol butyl ether ester (Dow H 1010) were included at 1, 1½ and 2 lb./A. Conditions were generally favorable for 2,4-D, but severe damage to beans resulted. Esteron 44 and ACP 648 produced the least injury; Formula 40, ACP 638 and ACP 646A next; LFN 472 next; while Dow H 1010 produced the most injury to beans of any 2,4-D. None of them can be recommended for soybeans at these rates. MCP was used at 2 pounds, and produced damage similar to the 2,4-D products, which persisted longer than with 2,4-D. IPC (ACP 644) was used at rates of 4 and 8 lb./A. Did a fair job of controlling grasses, some damage to beans. Of doubtful value.

PCP (phenol) in diesel oil (Dow H916) at 4, 8, 12, 16, and 20 lb./A. Gave best results on May 10 when some of the weeds had emerged. Also good June 13. Poor where applied at once after planting, May 4. 12 lb./A., best overall rate. PCP gives some excellent results, but is subject to weather and soil influences too much to be recommended. PCP (phenol) in aromatic oil (Shell 130) applied as sold at rates of 4, 8, 12, and 16 lb./A. Results identical with same rates of Dow H916. Sodium PCP, used at 8, 12, 16, and 20 lb./A., gave somewhat better results than the phenol, but is subject to the same limitations. Should be used in about 40 gallons water per acre - at least more than 10. Best overall rate, 16 lb./A., though 12 gave some good results. Xanthogen disulphide (Sulfasan) at 5, 7½, 10, 12½ and 15 lb./A., gave a little damage to both beans and weeds at high rates - 10 pounds was the best overall rate. The best results were May 10, with weeds partly emerged - apparently a contact herbicide with little residual effect. Cannot be recommended except for those conditions, unusual with soybeans. Sodium 3,6-endoxohexahydrophthalate (Sharples E.C. 3740) at 1, 2, 4, and 6 lb./A. gave good grass control at 4 and 6 pounds, with some control of broadleaved weeds and some stunting of beans, rapidly outgrown. Marked effects on grass roots. In the Aug. series we used 4 and 6 lb. E.C. 3740 with 1/2 and 1 lb. Esteron 44. The ½ lb. Esteron with either rate of 3740 gave the cleanest plots we had at any time, but one test does not prove anything.

We are not prepared to recommend any pre-emergence chemical for use on soybeans. They emerge too fast for contact herbicides, are sensitive to most residual herbicides, and, given half a chance, do such an excellent job of weed control by competition that it is hard to recommend any chemical on them. The dinitros are not perfect, but the best all-round chemicals so far, if one is to be suggested. (Contribution of the Ohio Agricultural Experiment Station.)

Effect of chemical weed killers upon field beans and soybeans. Churchill, B. R. and Grigsby, B. H. Earlyana soybeans and Michelite fieldbeans, planted in randomized and replicated plots were pre-emergence sprayed with 2,4-D at 2 lbs. per acre; dinitro, (Pre-merge)-2 lbs.; Sulfasan - 5 lbs.; and Experimental Herbicide No. 2 - 5 lbs. The field was fitted on May 24 and beans planted June 12. One-half of the field was refitted just before planting. Weed growth on plots sprayed with dinitro and 2,4-D was greatly delayed and considerably reduced in numbers. Rough pigweed and lambsquarters, however, were not eliminated. Refitting just before planting controlled weeds in the early part of the season but lambsquarters and rough pigweed came in later on plots not cultivated. Dinitro showed no injurious effect upon either fieldbeans or soybeans. Some injury did occur to both crops when 2,4-D was used. E.H. No. 2 killed both crops after a long period of delayed growth. Plots for yield records were harvested but the data are not yet complete. (Contribution from Michigan Agricultural Experiment Station.)

Herbicides in canning peas. Leefe, J. S. Pre-emergence applications of granular cyanamid 100, 200, and 400 pounds per acre, Isopropyl ester 2,4-D and propylene glycol butyl ether ester 2,4-D (Dow H 1010) both at 3/4 lb. acid per acre and dinitro phenol (Dow Premerge) at 10 quarts per acre were made to plots seeded to Perfection peas.

Post emergence treatments were made with a dinitro phenol (Dow Selective Herbicide) at 1½ and 3 quarts each in 35 and 70 gallons of water per acre, isopropyl xanthate 15 lbs. per acre in 35 gallons of water and powdered cyanamid (Aero Cyanamid Special Grade) 100 pounds per acre.

Plots had heavy infestation of wild radish (Raphanus raphanistrum), lambsquarters (Chenopodium album) and a lesser infestation of pigweed (Amaranthus retroflexus)

All pre-emergence treatments were applied three days prior to emergence of peas and the post emergence treatments were applied when peas were 6 inches high.

All pre-emergence treatments reduced the initial stand of weeds. None reduced stand of peas. Dow Premerge was outstanding in this respect, being as well longer lasting than the others.

Of the post emergence treatments Dow Selective at both rates and volumes gave satisfactory weed control with minimum damage to the peas. Isopropyl xanthate cause severe injury to peas. Powdered cyanamid gave generally poor weed control.

All treatments resulted in increased yields of shelled peas, but only in the case of Dow Premerge, isopropyl ester of 2,4-D, and Dow Selective Herbicide was the increase significant. (Experimental Station, Kentville, Nova Scotia, Canada.)

The selective control of wild oats in flax and in peas by TCA and Maleic Hydrazide. Carder, A. C. Five rates of TCA, nil, 10, 20, 40 and 60 pounds acetate equivalent per acre were applied to Redwing flax and Chancellor peas one day after they had been seeded in land heavily infested with wild oats (Avena fatua). Later, when the flax had emerged 1 inch, the peas 1½-2 inches and the wild oats 2 inches Maleic Hydrazide was applied at six rates: nil, 1, 2, 4, 8 and 12 pounds of the active ingredient per acre. Examination 2 months subsequent to treatment indicated that the wild oats were more susceptible to the pre-emergence TCA application than were either flax or peas and that the latter were intermediate to the wild oats and flax in their susceptibility. Ten pounds of TCA reduced the vigour of the wild oats 83 and that of the flax 45 per cent. The higher rates showed much less selectivity. Yield data, rendered extremely light by June drought and mid-August frost, indicated 19 and 64 per cent reduction in clean flax seed by the 10- and 20-pound rates, respectively. The post-emergence treatment of Maleic Hydrazide indicated a high susceptibility of flax to this chemical, while both peas and wild oats possessed moderate tolerance. Thus, 8 pounds of Maleic Hydrazide per acre stunted growth of flax to 5 per cent of that on the untreated controls, while the peas and wild oats retained 90 per cent of their vigour. (Contribution of Dominion Experimental Station, Beaverlodge, Alberta.)

Response of canning peas to applications of TCA, maleic hydrazide, and IPC. Buchholtz, K. P. Alaska peas planted on May 11, 1950 were treated on June 7 when about 6 inches high with the sodium salt of TCA, maleic hydrazide and an emulsifiable preparation of IPC at rates of 2, 4 and 8 lbs. per acre of the chemical or acid equivalent. Plots contained 18 sq. ft. and 4 replicates were used. Applications

were made in water equivalent to 40 gallons per acre. At the time of treatment moderate infestations of redroot (Amaranthus retroflexus) and foxtail (Setaria spp.) about 2 inches high were present in all plots. At canning stage the peas were harvested, shelled weights obtained, and tenderometer readings determined. Pea yields were not affected significantly by the TCA or maleic hydrazide treatments and averaged 2407 and 2580 lbs. per acre. Check plots yielded 2975 lbs. per acre while those treated with IPC yielded an average of 2068 lbs., a significant reduction. The 8 lb. application of IPC was especially harmful, apparently due to the burning action of the oil carrier on the pea leaves rather than due to the IPC itself. Tenderometer readings were significantly affected by some treatments. All plots receiving TCA had higher readings averaging 131 in comparison to 117 for check. Plots treated with 8 lbs. of maleic hydrazide were significantly retarded in development and gave tenderometer readings of 105. IPC applications had little effect on pea maturity. Significant control of the foxtail was obtained by the 4 and 8 lb. applications of TCA and the 8 lb. application of maleic hydrazide. The later application also gave significant control of redroot. IPC was ineffective in controlling growth of either grassy or broadleaved weeds. (Department of Agronomy, University of Wisconsin, Madison, Wisconsin.)

Yields and tenderometer readings of canning peas following treatment with 2,4-D and MCP. Buchholtz, K. P. Shoshone peas were planted on May 19, 1950 and treated on June 19 when they were about 12 inches high but before bloom had started. The sodium salt and an amine preparation of 2,4-D as well as an amine preparation of MCP were each applied at rates of 0.125, 0.25 and 0.5 lbs. per acre in water equivalent to 40 gallons per acre. Plots contained 18 sq. ft. and four replicates were used. At the time of treatment a moderate number of redroot (Amaranthus retroflexus) about 2 inches high were present in all plots. On July 20 the peas were harvested, shelled weights obtained, and tenderometer readings determined. Untreated checks yielded 2687 lbs. per acre. All of the treated plots except the 0.125 lb. application of MCP yielded significantly less than check. Plots treated with 0.125, 0.25 and 0.5 lbs. of MCP yielded 2929, 1946 and 1435 lbs. per acre respectively. The sodium salt and amine preparations of 2,4-D were more toxic to the peas giving average yields of 1544 and 1127 lbs. while the average yield of plots treated with MCP was 2105 lbs. Tenderometer readings were not affected significantly by any treatment and averaged 74 in this experiment. A later harvest date would have increased yields materially but differences due to treatment would probably have remained comparable. Redroot was controlled effectively by all materials and all rates used although the 0.125 lb. rate did not kill many of the plants. MCP appears to be more promising than 2,4-D for use as an herbicide in peas. (Department of Agronomy, University of Wisconsin, Madison, Wisconsin.)

Response of soybeans (Lincoln variety) to post-emergence sprays with 2,4-D. Oyer, E. B. and Lee, Oliver C. Replicated plots of soybeans were sprayed with three formulations of 2,4-D: (1) amine salt, (2) isopropyl ester, and (3) polypropylene glycol butyl ether ester, when approximately 8 inches in height. Each of the materials was applied in rates of 1/8, 1/4, 1/2, and 1 pound of acid per acre in 12 gallons of water. All materials when applied at the rate of 1/8 pound per acre caused injury to soybeans. Considerable lodging occurred; plants became brittle resulting in a slight reduction in stand. Plants were dwarfed and maturity delayed by the treatment. No significant difference between materials was noted at this rate. Injury increased as rates of application were increased. The 1/4 pound rate reduced the stand slightly while rates of 1/2 and 1 pound produced up to a 50 per cent kill of plants. All plants were stunted and produced abnormal growth. Plants remained green until frost while untreated check plots were mature three weeks

prior to that date. Soybeans sprayed with rates of 1/4 pound per acre or more developed a corky or rough surface of the stems, a sub-epidermal proliferation. (Contribution of Agricultural Experiment Station, Purdue University.)

Effect of materials applied as defoliants in soybeans. Lee, Oliver C. Several materials have shown promise for use as defoliants in soybeans were applied to plots of weedy soybeans. One series of plots was sprayed with ground equipment, the other by airplane. The materials used included pentachlorophenol in fuel oil and a special oil, Dinitro in fuel oil, aero cyanate, and a sodium chlorate and borax mixture in water. All the materials applied caused burning of foliage of both soybeans and weeds, including grasses. The materials had very little effect on the heavy stems of such weeds as jimson, horseweed and pigweed. There appeared to be very little difference between the results obtained from dinitro and pentachlorophenol in oil. Rates of 2, 4 and 6 gallons of spray per acre applied indicates that the maximum dosage is needed to assure adequate coverage to produce the desired results. This is particularly true in fields heavily infested with weeds. When sprays were applied approximately three weeks before normal maturity or when soybeans were still green in the pod, considerable discoloration and shriveling of beans occurred. This did not occur when sprays were applied later when beans were firm in the pod at the time of spraying. (Contribution of Agricultural Experiment Station, Purdue University.)

PROJECT III. CONTROL OF WEEDS IN FIELD CROPS

Pasture and Range Grasses. Summary by: Dayton L. Klingman

Summary

Six- and eight-week-old stands of crested wheatgrass, bromegrass, and western rye grass sprayed with 2,4-D (varied from 1/4 to 2 pounds per acre) gave good control of annual weeds. Each grass gave decidedly more vigorous and uniform stands the year of treatment. The year following treatment, all grasses also were more vigorous with better stands than the untreated plots.

Ironweed (Vernonia baldwinii, Torr.) were reduced 40 to 60 per cent with 1 pound 2,4-D per acre after two seasons of June treatments; 1/2 pound gave less than 30 per cent control.

Each of eleven materials was applied at 2 and 4 pounds per acre on pasture sage (Artemisia frigida). Materials included experimental and commercially available preparations of 2,4-D; 2 methyl, 4 chlorophenoxyacetic acid; and 2,4-D and 2,4,5-T combinations. Only five treatments had appreciable effect upon the roots 57 days after treatment. Four of these treatments were 2,4-D and 2,4,5-T combinations, and the other was 4 pounds per acre of butoxy ethanol ester.

In one exploratory test sodium TCA appeared to have promise as a control of slough grass, which impedes the flow of irrigation water or drainage water in ditches. The July treatments appeared to give somewhat better results than May treatments; effectiveness of September treatments was not yet apparent.

Abstracts of Results of Cooperators

Effect of 2,4-D on new seedings of cultivated perennial grasses. Friesen, H. A. The amine and ester formulations of 2,4-D were sprayed at the rates 1, 1½, and 2 pounds of acid equivalent per acre on six-weeks-old stands of crested wheatgrass, bromegrass, and Western rye grass, in the spring of 1949. These heavy 2,4-D applications very effectively controlled the heavy infestation of annual weeds such as flixweed, Russian thistle, and stinkweed on these plots. Each of the grasses showed a decided increase in vigor and height of growth and a greater uniformity or density of stand on the treated plots as compared to the weedy untreated plots, in 1949. Portions of the untreated plots were mowed in mid-July to control the rank weed growth.

In 1950 the effects of the weed control resulting from the 2,4-D spraying in 1949 were plainly visible in each of the grasses. Thus, on the treated crested wheat grass plots, the stand was an estimated 75 percent compared with 45 percent on the untreated plots. Furthermore, on the treated plots the grass was some 4 inches taller, had more tillers per plant and had larger appearing seed heads.

2,4-D treatments on eight-weeks-old stands of these grasses in 1950 using the ester and amine at 1/4, 3/8, and 1/2 pounds of acid per acre gave essentially similar results. (Contributed by the Dominion Experimental Station, Scott, Sask.)

Herbicidal control of ironweed (Vernonia baldwinii). Klingman, Dayton L. Treatment of ironweed in June of 1948 and 1949 with 1 pound per acre of ester, amine, and sodium salt formulations of 2,4-D has resulted in from 40% to 60% reduction in

stand, with the amine salt being slightly the more effective, to date. 2,4,5-T ester gave 71% reduction when applied at 1 pound per acre. All materials gave less than 30% control when applied at 1/2 pound per acre. (Contribution of the Division of Weed Investigations, B.P.I.S.A.E., and the Nebraska Agricultural Experiment Station, cooperating.)

Effect of various systemic herbicides on pasture sage (Artemisia frigida) 1950. Pavlychenko, Thomas K. Plots 16' x 100', infested with pasture sage almost to the exclusion of other plants, were treated on July 17th, in the pre-bud stage, with 2 and 4 lbs./a. of ACP 784 (ester of 2,4-D); ACP 954 (amine salt of MCP); ACP 903 (ester of para.); ACP 912 (esters of para. 2,4-D and 2,4,5-T); ACP 926 (acid of 2,4-D and 2,4,5-T); Weedone Brush Killer 32 (2,4-D and 2,4,5-T in proportion of 2:1); Weedone Concentrate 48 (ethyl ester of 2,4-D); Weedone LV 4 (butoxy ethanol ester of 2,4-D); ACP 649 (ester of 2,4-D); ACP 646A (2,4-D acetanilide) and ACP 675A (2,4-D amylamide); all in oil. The soil was a sandy loam and was being pastured. Untreated areas served as checks. RESULTS: 57 days after treatment, 100 pct. top kill was recorded in ACP 784 (both rates), ACP 926 (4 lbs./a.), Weedone Brush Killer 32 (4 lbs./a.) and Weedone Concentrate 48 in oil (4 lbs./a.). Top kills of 80 pct. or more were given by ACP 903, 95 pct. (4 lbs./a.); ACP 646A, 90 pct. (4 lbs./a.); Weedone Brush Killer 32, 85 pct. (2 lbs./a.); ACP 649, 80 pct. (4 lbs./a.); Weedone Concentrate 48, 80 pct. (2 lbs./a.) and ACP 954, 80 pct. (2 lbs./a.). Other treatments gave lower kills. At the end of September, regrowth was absent in 12 out of the 22 treatments used; in other treatments it was from 5 to 20 pct. Only two treatments, namely, ACP 954 and Weedone Brush Killer 32 at 2 lbs./a. rates, gave 70 pct. regrowth. The only chemicals which had any appreciable effect on the root system were ACP 926 (4 lbs./a.), Weedone Brush Killer 32 (both rates), and Weedone LV 4 (4 lbs./a.). In all the plots where the kill of pasture sage was high, the native grass has increased. These results are of a preliminary nature and final results will be taken in 1951 and 1952. (Contributed by Agr. Div., American Chemical Paint Company, Saskatoon, Sask.)

Slough grass control with TCA. Viehmeyer, Glenn and C. G. Petty. Slough grass, Spartina pectinata, Link., is a serious weed of irrigation ditches where it clogs ditch channels and impedes rate of flow of water. Mechanical control is costly. Effective chemical control is desirable. In an exploratory investigation, Sodium TCA appears to have promise as a control. Dosages of 24.2, 48.4, 72.6 lbs. per acre of TCA in water applied as a foliage spray May 17, July 17, and September 28, 1950, to an established stand of Spartina reduced plant vigor to a degree that would eliminate ditch clogging. The two higher rates resulted in considerable stand reductions as well: Stand reduction was greater following July treatment than following May treatment. The scattered plants surviving May treatment appeared more vigorous than those in the untreated check, probably due to reduced stand competition. Plants surviving July treatment were much less vigorous than the check, indicating that date of application may be a factor. Stand reduction was also greater in July treatments. Period of elapsed time between date of treatment of the September 28 plots and date of data collection (October 13) was too short to evaluate results; but examination shows extensive damage to rhizomes to a depth of four inches despite the fact no rain fell to leach TCA into the soil between dates of application and observation. This would seem to indicate translocation of the herbicide from leaf to root in Spartina. TCA appears promising for controlling this grass, but additional data on date and rate of application are needed before recommendations can be made. (University of Nebr., North Platte Sub-Station, and Lincoln County Noxious Weed District, Contributing agencies.)

Project IV. Control of Weeds in Vegetable Crops, Potatoes, Sugar Beets, Small Fruits and Ornamentals

Small Fruits and Ornamentals — R. E. Nylund

Summary

Abstracts received covering herbicidal studies with small fruits and ornamentals included five reports on strawberries, two on crabgrass control in turf, two on gladioli, one each on peonies and nursery stock, and three on the control of quack grass in nursery plantings.

The reaction of strawberry plants and weeds to several herbicides are reported. In one report, single applications of 2,4-D applied at 2 lbs. per acre as a pre-planting treatment or 1 lb. as a summer spray gave satisfactory weed control with no apparent injury to strawberry plants; in another report, as little as ½ lb. seriously reduced runner production when applied 17 days after planting and again six weeks later. E.H. #1 when used at 4 lbs. per acre appears to have promise for controlling both broad-leaved weeds (including purslane) and grasses in strawberries. Rates lower than 3 lbs. are less effective in weed control while rates as high as 8 lbs. apparently reduce runner plant production. E.H. #2 when used as a pre-planting treatment at 12 lbs. per acre gave satisfactory weed control for a period of four weeks without damage to strawberry plants; however, when used as a summer spray rates as high as 6 lbs. did not give satisfactory weed control. E.H. #2, IPC, E.H. 5722, Endothal, and M.H. sprayed on growing strawberry plants failed to control weeds without seriously damaging the crop plants. Attempts to control Stink Grass (Eragrostis cilianensis, Link.) in strawberries through the use of E.H. 5722 at 2 to 8 lbs., Sharples' E.C. 3740 at 1 to 4 lbs., and IPC at 8-16 lbs. were unsuccessful. The higher rates of all three chemicals caused temporary localized burning of strawberry leaves.

Although the problem is undoubtedly being widely studied, only two reports on the control of crabgrass in turf were received. Both of these report PMAS (in the form of Tat-C-Iect) to be effective in controlling crabgrass without injury to bluegrass. Sowa's S-1998 when applied three times gave excellent crabgrass control with only slight retardation of bluegrass growth. Stoddard Solvent at 80 gal. per acre gave excellent crabgrass control but killed the bluegrass wherever the spray had overlapped. Potassium cyanate (Weedone Crabgrass Killer) gave only fair crabgrass control while L-2988 (Standard Crabgrass Killer), L-2687, Kerosene, E.H.2, S-1980, TCA, and Maleic hydrazide were ineffective in controlling crabgrass.

Two reports on weed control in gladioli indicate that this crop is quite resistant to the action of herbicides. Chemicals effective in controlling weeds without injury to the glads when applied prior to crop plant emergence were DNOSBP, 2,4-D (Na salt), combinations of the above, Stoddard solvent fortified with PCP, Xanthogen disulphide, TCA, Methyl bromide (containing chloropicrin), PCP, Premerge (DNOSBP-amine salt) and a combination of PCP plus TCA. The dinitros, according to one report, noticeably improved the foliage color and vigor of the gladioli. Post-emergence applications of potassium cyanate alone or in combination with 1 lb. of 2,4-D when the gladioli were 5" tall also gave fair to good weed control without crop injury. Combination pre- and post-emergence treatments with TCA, Premerge, and PMAS were also effective in controlling weeds without crop damage.

Peonies were not injured when treated prior to emergence with 2,4-D (Na salt) alone, DNOSBP (NH_4 salt) alone, combinations of these, and Stoddard solvent alone or fortified with PCP. As with gladioli, dinitro-treated peonies showed improved vigor

and leaf color. Grasses as well as broad-leaved weeds were completely controlled with fortified Stoddard solvent. Excellent control of broad-leaved weeds was obtained with DNOSBP, fair control with 2,4-D, and poor control with Stoddard solvent alone.

One report on weed control in nursery crops indicated that transplant beds of various Juniperus species were not injured by Stoddard solvent applied when temperatures were above 80°F. Although TCA and PCP gave good control of weeds, they and Dow General caused injury to Juniperus. In a second test, applications of Stoddard solvent, DNOSBP, and PCP stunted Van Houte Spirea. PCP caused temporary injury to Chinese Elm, Douglas Fir, and Black Raspberry. Peonies were killed to the ground. Apparently the above herbicides did not damage Lilac, Pecan, Barberry, Flowering Quince, American Arbor Vitae and Western Yellow Pine in nursery rows. PCP gave best overall control of weeds.

Early summer applications of TCA at 20 to 80 lbs. per acre effected good control of quack grass in nursery fields. Growth of broad-leaved weeds such as ragweed, horse nettle, and thistle in these plots was controlled discing. Hemerocallis hybrids, Kniphofia uvaria, Iris kaempferi, and Elder Daisy (Chrysanthemum leucanthemum var.) planted in August and September on land treated with TCA in June appeared to be uninjured by the TCA treatments.

Abstracts of Results of Cooperators

Further testing of herbicides in strawberry plantings. Carlson, R. F. One acre of the Premier variety of strawberries was designed into fifty-foot row sections so that each treatment could be replicated four times. All treatments were made seventeen days after planting and then again six weeks later, July 18. Each herbicide was applied with a knapsack sprayer at three rates per acre. The herbicides included in these tests were: 2,4-D, IPC (Isopropyl-N-Phenolcarbamate), EH_1 (Sodium 2,4-Dichlorophenyl Sulfate), EH_2 (Dichloral urea), and EH 5722. Weed counts and hoeing time of each treatment were taken (June 28 and August 15) during the growing season, and runner counts were made September 27. Since this was the first season of the planting no fruits were allowed to form, hence no yield data were obtained. The new material EH_1 at 3 and 4 pounds per acre controlled the weeds as well as 2 pounds of 2,4-D. No injury and no reduction in runners was noticed from the use of EH_1 whereas, 2,4-D retarded growth and reduced runners by 46 per cent at the 1/2-pound rate and 91 per cent at the 2-pound rate. (Note that the second application was made when runners normally are initiating.) Under the conditions tested the materials IPC, EH_2 and EH 5722 did not show as much promise in weed control in strawberries as did EH_1 and 2,4-D. Runner production was also reduced with these materials. As recorded hand labor was reduced by two-thirds where EH_1 and 2,4-D were used, and by about one-third with the other materials. (Horticulture Department, Michigan State College, East Lansing, Michigan).

The Control of Quack Grass in Nursery Fields with Sodium Tri-chloroacetate (TCA). Chadwick, L. C. and Dickinson, Charles. Approximately 1/4 acre plowed plots were treated June 2, 1950, with TCA at rates of 20, 40, 60 and 80 pounds per A. Plots were replicated once. Sectional areas of each treated plot and a check plot were disced (1) every 2 weeks, (2) every 4 weeks and (3) once during the summer (Aug. 1). One section was not disced. Observations made Sept. 2 showed good control of quack grass in all treated plots regardless of the frequency of discing. (Contribution of the Ohio Agricultural Experiment Station.)

Discing Necessary to Control Weed Growth in Nursery Fields Treated with Sodium Tri-chloroacetate (TCA) to Control Quack Grass. Chadwick, L. C. and Dickinson, Charles. Considerable growth of rag weed, horse nettle and thistle occurred in plowed but uncultivated replicated 1/4 acre plots treated with TCA at rates of 20, 40, 60 and 80 pounds per A to control quack grass. Under conditions of this experiment, applications of 20# - 40#/A of TCA with discing once a month appears to be a logical practice to follow for the control of quack grass and the weeds mentioned. (Contribution of the Ohio Agricultural Experiment Station)

The Tolerance of Some Herbaceous Ornamental Plants to Soil Treatments of Sodium Tri-chloroacetate (TCA). Chadwick, L. C. and Dickinson, Charles. Sandy loam soil plots were treated with TCA at rates of 20, 40, 60 and 80 pounds per A on June 2, 1950, for the control of quack grass. Plants of Hemerocallis hybrids and Kniphofia uvaria were planted in all areas the first week in August. Similar plantings of Iris kaempferi were made in mid August and of Elder Daisy (Chrysanthemum leucanthemum var.) during the first week of September. With the exception of the Elder Daisy, these ornamental plants are usually transplanted in late summer or early fall and make but little growth until the following spring. Fall observations indicated satisfactory tolerance of these perennials to all treatments of TCA. (Contribution of the Ohio Agricultural Experiment Station)

Weed control with E. H.#1 in new strawberry plantings. Denisen, E. L. and D. W. Staniforth. Dunlap strawberry plants planted in the spring of 1950 in a sandy loam soil were sprayed with 0, 2, 4 and 8 lbs. of E.H.#1 per acre on June 16 and July 7. The entire experiment of five replications was hand hoed prior to each spray application. The first spray of the 4 and 8 lb. treatments gave excellent control of purslane and grasses, the principal weeds present in the check plots. The 2 lb. rate also cut down the weed stand appreciably, but necessitated more hand hoeing than 4 and 8 lbs. Grasses were the more serious problem after July 7 and were controlled effectively by the 4 and 8 lb. applications. There was no reduction in plant stand for any of the treatments; however, the rooting of runners was inhibited to some extent. Runner counts on August 2 indicated a significant decrease in runner set. Rooting of runners was decreased by 28, 40 and 67% respectively for the 2, 4 and 8 lb. treatments. Drouth conditions which prevailed following the July 7 spray may have been responsible to a considerable degree in reducing rooting of runners. However, counts taken on September 15, after a period of more precipitation, showed a significant reduction in runner set only for the 8 lb. treatment. These reductions were 13, 26 and 55% for the 2, 4 and 8 lb. treatments respectively. Production records will be taken in the spring of 1951. (Contr. by Iowa Agricultural Experiment Station, Ames, Iowa)

Maleic hydrazide on strawberries. Denisen, E. L. Concentrations of 1000 and 2000 ppm. of M.H. were applied on June 14 to spring-planted Dunlap strawberry plants to inhibit runner production. With both treatments new runners formed and grew to a length of 4 to 6 inches and then stopped. New leaves produced on the sprayed plants were very yellow in color with the most severe chlorosis at 2000 ppm. A urea foliage spray (Nugreen) was superimposed upon the experiment to clear up the chlorosis; however, in both the urea treated and untreated plots the new leaves became deeper green in color and runner development started again. The plants were sprayed with M.H. again on July 14 and runner development was again stopped. A month later runners were beginning to form again; however, a third application was not made. Counts of rooted runners on September 18 gave the following as the average number of runners per plant: check, 24.0; 1000 ppm., 3.8; and 2000 ppm., 1.3. The urea foliage spray did not increase the number of runners formed in any of the treatments. Yields of the several plots will be taken in the spring of 1951. (Horticulture Department, Iowa Agricultural Experiment Station, Ames, Iowa)

Control of weeds in nursery stock. Foret, J. A. Preliminary work indicated that Juniper species, scopulorum, ponderosa and virginiana were not injured by Stoddard solvent (75 GPA) sprays when the herbicide was applied in May and July when the temperatures were above 80°F. Dinitro (Dow General), 1 pt. in 5 gal. fuel oil in 50 gal. water at 75-100 g.p.a., Na salt PCP 2% sol. 75-100 g.p.a. and TCA 15 lbs. in 75 g.p.a. caused moderate to severe burning injury when applied to transplant beds. TCA and PCP gave best control of weeds including shepherd's purse, peppergrass, red root, foxtail and purslane. In 1950, Stoddard solvent, Dinitro and PCP were applied the same as above with the exception that a hooded boom was used with a low pressure spray to minimize drift. The nursery crops sprayed in two locations were Pfitzer's Juniper, Black Hills spruce (1st year and 2nd year), Chinese Elm, Lilac, Pecan, Barberry, Spirea Van Houte at one location and Black Raspberry, Flowering Quince, American Arbor Vitae, Douglas Fir and Western Yellow Pine also at the second location. Spirea Van Houte was stunted by all materials at both locations. The lower leaves of Chinese Elm were injured by drift from PCP but secondary growth appeared and by midsummer the trees appeared normal. Spray injury was noted in the PCP plots of the second location in plots of Black Raspberry, Peony and Douglas Fir. Injury in Black Raspberry was apparent on leaves of the fruiting wood before fruit ripening. Peonies were killed to the ground and showed no signs of recovery by late summer. Douglas Fir was almost completely defoliated but new growth appeared by late summer. PCP gave best overall residual control of weeds. (Contributed by Iowa Agr. Exp. Station, Ames, Iowa)

A Comparison of Certain Chemicals with 2,4-D for Weed Control in Strawberries. Hemphill, D. D. Experimental Herbicide 1, Experimental Herbicide 2, Maleic hydrazide, Endothal and 2,4-D were used as pre-planting and summer sprays (July and August) in strawberries. Each material was used separately and 2,4-D was also used in combination with each of the other chemicals. Pre-planting applications of Experimental Herbicide 1, 4 pounds/acre, and Experimental Herbicide 2, 12 pounds/acre, gave fairly satisfactory control of broad and narrow leaf weeds for approximately four weeks without apparent damage. Lower rates of these materials did not give satisfactory control. Endothal, 3 and 5 pounds/acre gave satisfactory control of broad and narrow leaf weeds but caused severe damage to the strawberry plants. A one-pound rate did not give satisfactory weed control. Maleic hydrazide 12 pounds/acre did not give control of broad or narrow leaf weeds. No serious injury to plants was evident at this rate. Amine salt 2,4-D 2 pound/acre acid equivalent helped considerably in weed control with no apparent injury to the strawberries. Some combinations of 2,4-D with other chemicals especially Herbicide 2 gave excellent weed control but considerable damage to strawberries resulted.

As summer sprays, Experimental Herbicide 1, 1, 1½ or 2 pounds/acre and Experimental Herbicide 2, 2, 4 or 6 pounds/acre did not give satisfactory weed control. Higher rates of these materials may give satisfactory weed control without serious damage to the plants. Endothal, ½ pound/acre, caused considerable damage and did not control weeds. Higher rates were too toxic. Maleic hydrazide showed no promise for summer sprays at rates up to 8 pounds/acre. Amine salt 2,4-D 1 pound/acre acid equivalent gave very satisfactory control of both broad and narrow leaf weeds.

Combinations of 2,4-D and other chemicals did not give better weed control than 2,4-D alone and decreased runner production. (Contribution from the Department of Horticulture, Missouri Agricultural Experiment Station, Journal Series No. 1234)

Chemical weed control in gladiolus. Holm, L.G. and Beck, G.E. On June 5 eighteen plots of gladioli consisting of four 12 foot rows each were planted in a Miami silt loam soil. Each row contained 20 corms of the White Gold variety, 6 of Lady Jane, 6 of Ethel Cave Cole, and 4 of Snow Princess. The chemical treatments

described below were applied beginning on June 13, stand counts of weeds and crop were taken on August 3 and subsequent to that date two of the rows in each plot were kept free from weeds. The predominant weeds in the area were purslane (Portulaca oleracea), pigweed (Amaranthus retroflexus), barnyard grass (Echinochloa crus-galli), lamb's quarters (Chenopodium album) and smartweed (Polygonum hydropiper). The corms were harvested on October 28. The following pre-emergence treatments were applied (all concentrations referred to below are in pounds per acre of acid equivalent or active ingredient of the appropriate compound): Sulfasan (ethyl xanthogen disulfide) 10 and 25 pounds; TCA (sodium salt) 15 and 30 pounds; methyl bromide (97.5 percent plus 2 percent chloropicrin) 1 pound per 100 square feet; PCP (sodium salt) 5 pounds; Premerge (DNOSBP) 3 pounds; 2,4-D (sodium salt) 2.5 and 5 pounds; and a combination of chemicals consisting of PCP 5 pounds and TCA 15 pounds. Post-emergence sprays applied when plants were 5" high were as follows: 15 pounds of potassium cyanate with 1 pound of 2,4-D; and 15 pounds of potassium cyanate with an additional application at the same rate 3 weeks later. Combination pre- and post-emergence treatments were as follows: TCA 15 pounds before emergence and 5 pounds 3 weeks later; Premerge 3 pounds before emergence and again 3 weeks later; 2,4-D 2.5 pounds before emergence and 1 pound 3 weeks later; and phenyl mercuric acetate 4 pounds before emergence and 4 pounds 12 days later. Two check plots were included. The post-emergence treatments with potassium cyanate and the phenyl mercuric acetate applications reduced the weed stands by about 65 per cent. All other treatments reduced the weed counts by about 80 per cent. Yield data on spike and floret production was taken at fourteen separate harvests. The treatments effected no apparent delay in time of bloom production as compared with the controls. The total floret production in all plots was equal to or exceeded that of the controls and the total spike production per plot showed no marked reduction as a result of any of the treatments. Fewer florets were produced in the unweeded than the weeded rows of the plots. Corm yields and numbers could not be obtained in time for inclusion in this report. (Contrib. of the Dept. of Horticulture, University of Wisconsin, Agricultural Exp. Station, Madison, Wis.)

Crab grass control in specialized turf areas. Lantz, H. L. Two years of treatments with Tat-C-Lect has produced remarkable results in clearing crab grass out of the Iowa State College football field. This football field has been fertilized regularly for years and was regarded as one of the top pieces of football turf in the middle west. In spite of good treatment as to fertilization, watering, etc., crab grass became a serious menace to an otherwise excellent piece of turf. The first Tat-C-Lect treatments were applied in 1949, and with excellent results. In 1950 the treatments were continued, and at this date October 10, 1950, the crab grass is almost non-existent. The evidence in the middle west is that when the phenol-mercuries are used, the key to crab grass control problem is early and repeated applications, that and continued effort for a period of two or more years. This appears to be true on golf greens as well as other fine turf areas. On two greens at a local country club, goose grass was becoming a serious pest. Applications in 1948 and again in 1949 of phenol mercury acetate applied when two leaf stage of development had been reached was without result. In 1950 the same material applied about 3 weeks before the germination resulted in an estimated control of 95 to 98 per cent. (Contr. by Iowa Agr. Experiment Station, Ames, Iowa)

A study on the value of herbicides for the control of crabgrass in turf. Nylund, R. E. Bluegrass turf, having a dense stand of crabgrass, was sprayed with 11 herbicides starting on July 13 when the crabgrass had 2 to 4 leaves. Each of the following treatments was applied to four 10' x 10' plots: L-2988 (Standard Crabgrass Killer), L-2687, and Stoddard Solvent at 80 gallons per acre; Kerosene at 120 gal. per acre; E.H. #2 (dichloral urea) at 5 lbs. in 80 gal. water per acre;

Potassium cyanate (Weedone Crabgrass Killer) at 7.4 lbs. in 305 gal. water; S-1980 and S-1998 at 18.75 lbs. in 360 gal. water; TCA (Na salt) at 10 lbs. in 80 gal. water; Maleic hydrazide at 0.3% solution at 160 gal. per acre; and phenyl mercuric acetate (Tat-C-Lect) at 0.79 lbs. in 87 gal. water. The rates indicated above refer to quantity of active ingredient applied. The commercially available herbicides were applied according to manufacturers' directions. S-1980 and S-1998 were re-applied 4 and 8 days after the initial application; kerosene and Tat-C-Lect reapplied in 7 days; and L-2988, L-2687, E.H.#2, and potassium cyanate were reapplied after 10 days. The other treatments were applied only once. For all applications the soil was moist, air temperature ranged from 65°-75°F., and grass was clipped at 1½". Sprays were applied with a knapsack or Sure-Shot sprayer operated at 50 lbs. pressure. Only Tat-C-Lect, S-1998, and Stoddard solvent gave 100% control of crabgrass. The Tat-C-Lect caused no injury to the bluegrass, S-1998 only slightly retarded growth of the bluegrass, while Stoddard solvent killed the bluegrass wherever the spray had overlapped. Of the remaining herbicides potassium cyanate gave fair control (80%) of the crabgrass without injury to the bluegrass, while the other herbicides tried either gave no crabgrass control or slight control accompanied by equally severe damage to the bluegrass. (Paper No. 725 of the Miscellaneous Journal Series of the Minnesota Agricultural Experiment Station).

Pre-emergence chemical control of weeds in gladiolus. Taylor, Clifford E. Gladiolus var. "Maid of Orleans" growing in silt loam soil was treated on May 20 (2 - 8 days before emergence) with various pre-emergence herbicides. Treatments included NH_4-DNOSBP at 6 pounds, DNOSBP-amine salt at 4, 6 and 8 pounds, Na-2,4-D at 1 pound, NH_4-DNOSBP at 6 pounds plus Na-2,4-D at 1 pound, each in 100 gallons of water per acre, Stoddard solvent at 60 gallons fortified with PCP at 4 pounds per acre, plus unsprayed checks. There was an occasional small weed present at time of treatment. The soil surface was dry and the temperature 68°F. For the week prior to treatments the mean temperature was 55°F. with no rainfall. For the two weeks following treatments the mean temperature was 63°F. and the rainfall: 5/22 - 0.04", 5/23 - 0.03", 5/26 - 0.02", 5/30 - 0.08", 6/1 - 0.04", 6/3 - 0.08", 6/4 - 1.03" and 6/5 - 0.04". Major weeds present were pigweeds (Amaranthus sps.) and purslane (Portulaca oleracea). Total weed control was 87% with NH_4-DNOSBP at 6 lbs. 84%, 82% and 95% with DNOSBP-amine salt at 4,6 and 8 lbs. respectively, 82% with Na-2,4-D at 1 lb., 90% with the combination of NH_4-DNOSBP and Na-2,4-D, and 81% with the fortified Stoddard solvent. However, weed populations were too varied for statistically significant control. The dinitros at 6 and 8 pounds per acre noticeably improved the foliage color and vigor and flower substance of the gladiolus. At the early bud stage there seemed to be a slight stunting effect to the gladiolus on the Na-2,4-D plots, but this effect was not discernible when in full flower. There was no flower stalk curvature from any treatment. There was no statistically significant effect on bulb size or bulblet number of the gladiolus from any treatment. (Contribution of the Illinois Agr. Exp. Station, Urbana, Illinois.

Pre-emergence chemical control of weeds in peonies. Taylor, Clifford, E. Treatments were applied to peonies in a silt loam soil on May 6. An occasional peony shoot had emerged, some up to two inches. The temperature was 56°F. and the soil surface moist. For the week prior to treatment the mean temperature was 51°F. and the rainfall: 5/1 - 0.04", 5/4 - 0.32" and 5/5 - 0.02". For the two weeks following treatments the mean temperature was 57°F. and the rainfall: 5/6 - 0.17", 5/9 - 0.23" and 5/10 - 0.01". Weeds were mostly pigweeds (Amaranthus sps.) and grasses, and the remainder various annuals and perennials. The grasses and a few broad-leaf weeds had emerged at the time of treatments. Treatments included Na-2,4-D at 1 and 1½ pounds, NH_4-DNOSBP at 6½ pounds, NA-2,4-D at 1 pound plus NH_4-DNOSBP at 5 pounds, Na-2,4-D at 1½ pounds plus NH_4-DNOSBP at 6½ pounds, all in 100 gallons of water per acre, Stoddard solvent at 80 gallons, and Stoddard solvent at

80 gallons fortified with PCP at 8 pounds per acre, and untreated checks. Small grasses were killed by the Stoddard solvent alone, but the fortified solvent killed or controlled all grasses. The other treatments did not control grasses. Control of broad-leaf weeds four weeks after treatments was complete with the fortified solvent and all treatments containing dinitro, fair on the Na-2,4-D plots and poor when the solvent was used alone. Peonies emerged before treatment showed occasional shallow "spot-burning" of the shoot from Stoddard solvent but there was no evidence of injury to the stalk proper or to the enclosed flower bud. There were no visible detrimental effects to the peonies from any treatment. There was a definite increase in vigor and leaf greenness on the dinitro-treated plots. (Contribution of the Illinois Agricultural Experiment Station, Urbana, Illinois)

Stink grass in strawberries. Viehmeyer, Glenn. An attempt to control Stink Grass, (Eragrostis cilianensis, Link.) in strawberries was not successful. The grass was represented by plants in all stages of growth, ranging from newly emerged seedlings to plants in the early stages of fruiting. The specie appeared resistant in all growth stages. Three herbicides were included in the trial; Carbide and Carbon's EH 5722 at 2, 4, and 8 lbs. per A.; Sharples' EC 3740 at 1, 2, and 4 lbs. per A., and IPC at 8 and 16 lbs. per acre. A randomized block design of four replications was used for the trial. A light to medium stunting of the grass plants was noted for the first four to six weeks, but recovery was apparently complete in time for a seed crop to mature. The heavier rates of all three chemicals resulted in severe burning of strawberry foliage; this effect appeared to be localized in the leaves and no systemic symptoms appeared in the plants at any time following treatment. Damaged leaves were replaced by new ones and all evidence of plant injury had disappeared in a few weeks. (Contribution of North Platte Sub-Station, University of Nebraska)

Project IV. The Control of Weeds in Truck Crops, Potatoes, Sugar Beets, Small Fruits, and Ornamentals.

Sugar Beets

B. H. Grigsby

Summary

Fourteen abstracts were received, ten of which were from results of pre-emergence applications and four from post-emergence treatments of sugar beets. Most of the reports were on screening type applications but a few were from trials on a farm scale.

Numerous herbicides were used in the various experiments, however, nine compounds were used in the majority of the reports. These nine are TCA, dinitrophenol, pentachlorophenol, xanthogen disulfide, maleic hydrazide, IPC, disodium endoxyhexahydrophthallate, dichloral urea (EH #2), and various forms of 2,4-D. A few other compounds were reported by one or more investigators.

There was general agreement in the reports that TCA, at rates up to 15 lbs. per acre, was fairly effective in the control of annual grasses, especially foxtail, and that these rates were not injurious to beets. Broad-leaved weed species were not affected by TCA at any dosage reported.

Results obtained with dinitro and pentochlorophenol were erratic and serve to emphasize the fact that these compounds are not reliable under all climatic conditions and that general suggestions for their use in sugar beets are not warranted.

Data from trials of maleic hydrazide, dichlorol urea, xanthogen disulfide, and IPC are inconclusive. These compounds, however, gave results promising enough to justify further trials of the materials at other rates of application.

The results reported for post-emergence trials were, in most cases, concerned with the effects of those materials used for pre-emergence tests upon beets and established weeds. No successful control was reported. E.C. 5722, was used by several investigators but did not control the weeds present in the trial areas.

The results reported in 1950 indicate that limited suggestions for the use of TCA to control annual grasses in beets may be made for 1951. Other compounds, and other weeds, require more research before general recommendations can be made.

Post-emergent chemical treatments for weed control with sugar beets. Andersen, E.T. and Shadbolt, C.A. Applications of 3001 (Sharples Chems. Inc.) at 4, 8, 12, and 20 pounds of active ingredient per acre gave 100 per cent complete control of all weeds and destroyed all beets. At 2 pounds per acre, about 75 per cent of wild oat plants (Avena fatua) were destroyed, with about 50 per cent of the beets surviving the treatment. 3740 (Sharples Chems. Inc.) at 1 quart per acre killed nearly 100 per cent of the green foxtail (Setaria viridis), but did not affect wild oats or beets. At 4 quarts per acre the vigor of the beets was slightly reduced, and only very slight injury to the wild oats was evident. At 8 quarts, the beet stand was reduced by 50 per cent, and both green foxtail and wild oats were completely eradicated. 5722 (Carbide and Carbon Chems.) at 1 pound per acre showed no effect upon the wild oats, green foxtail or beets. At 6 and 12 pounds per acre, there was nearly a complete kill of green foxtail, with no effect upon wild oats or beets. Maleic hydrazide, applied at 8 pounds per acre, caused a gradual destruction of wild oats, green foxtail, and beets, which was complete after 5 weeks. At 4 pounds, the beets were severely stunted, but not killed and weeds were controlled 100 per cent. Sodium chloride applied at 100 pounds per acre gave unsatisfactory control of broad leaved annuals. At 200 and 300 pounds per acre good control of annuals, mostly mustard (Brassica arvensis), was obtained. There was no effect upon wild oats or perennial sow thistle, and only a slight reduction in beet vigor. Polybor gave results similar to those of sodium chloride. 480 pounds per acre were required to control the broad-leaved weeds. The beets at this rate were not injured. (Contrib. of Division of Plant Science, The University of Manitoba, Winnepeg.)

Pre-emergent chemical treatments for weed control with sugar beets. Andersen, E.T. and Shadbolt, C.A. Screening tests were again conducted with sugar beets in cooperation with the North Central Weed Control Conference. ACP 646, ACP 638, and ACP 472 were found to be extremely injurious to the beets, causing symptoms typical of 2,4-D treatments. ACP 644 applied at 2, 4 and 8 pounds per acre appeared to give good control of wild oats (Avena fatua), with little effect upon green foxtail (Setaria viridis) or the beets. Maleic hydrazide at 4 pounds per acre caused serious injury to the beets, and gave complete control of wild oats, and green foxtail. A slight chlorotic effect was observed on perennial sow thistle, (Sonchus arvensis) following this treatment. Xanthogen disulfide, at 10 pounds per acre, destroyed 50 per cent of the emerged broad-leaved annual weeds, with no effect upon the beets. Sodium TCA resulted in a gradual reduction in vigor of the wild oats, which finally died about 6 weeks after treatment. Sinox at 1, 2 and 3 pounds per acre applied in 40 gallons of diesel oil per acre gave good control of wild oats, which had emerged at time of treatment. There was no effect on the beets. Premerge at 3, 6, and 9 quarts per acre applied on June 16 gave good control of wild oats, with no effect on the beets. In a similar treatment applied on July 13, made on a later planting of beets, the beets and wild oats were both entirely eliminated. For several days following the first treatment the weather remained dry, whereas with the second treatment, rain fell the day following. (Contrib. by the Division of Plant Science, The University of Manitoba, Winnipeg.)

Control of weeds in sugar beets. Bakke, A. L. and D. W. Staniforth The screening tests, inaugurated in 1949 in cooperation with the American Crystal Sugar Company of Mason City, Iowa, involving pre-emergence applications to control weeds in sugar beets showed that of the 20 different chemicals used EH #1, EH #2, IPC, TCA(Na) appeared promising. TCA Na at rates of 10, 15 and 20 pounds per acre applied directly after seeding, or at four days afterwards, was the most effective. In 1950, Acetanalide of 2,4-D, IPC, EC 3740, EH #1, EH #2, Xanthogen disulfide, TCA, Na salt, and TCA, Ca salt, were used. Excellent weed control results were obtained with TCA

Na salt, and TCA, Ca salt, with 10 and 20 pounds per acre with no effect on the beets. Beet plots were practically free of foxtail for 10 weeks after application. Good results were also obtained with EC 3740 at the two and four pound rates. Mr. Delmar Ogden, of the American Crystal Sugar Company, treated areas in a number of commercial fields with five pounds TCA, Na salt, per acre and obtained good control of foxtail. Ground treated with 36 pounds TCA, Na salt, per acre, on September 29, 1949, showed no residual effect in 1950. (Contribution Iowa Agricultural Experiment Station, Ames, Iowa).

Control of grassy weeds in the sugar beet crop with sodium trichloroacetate in Northern Iowa. Downie, A. R. and D. B. Ogden Results of two years plot testing indicated that sodium trichloroacetate showed promise of controlling grassy weeds in sugar beet agriculture. In 1950, 90 percent sodium trichloroacetate was applied at the rate of 5, 10, 15, and 20 pounds per acre in strips in five farmers' beet fields in Northern Iowa. The material was applied at the rate of 40 gallons of solution (water) per acre within two days after seeding the beets. There was an indication of slight reduction in emergence stands at rates above 15 pounds per acre but in no case did this have any effect on the thinned stands. There were no visible indications of injury on the foliage or on the roots of the beets during the growing season. Excellent control of Setari viridis, S. glauca, and Echinocloa crus-galli was obtained at all rates of application. The chemical had little, if any, effect on broad-leaved weeds such as lamb's quarters and pigweed. There were no appreciable differences in sucrose content or in apparent purity of the beet juice for any of the treatments as compared to the untreated strips. Yields tended to be higher in the treated strips due, no doubt, to less competition with grassy weeds. (Contrib.from American Crystal Sugar Company, Beet Seed Operations, Rocky Ford, Colorado.)

Some effects of post-emergence applications of herbicides to sugar beets. Grigsby, B. H. Two formulations of endoxyhexahydrophthalate, E. C. 5722, all at 2 and 4 pounds per acre, and IPC at 10 lbs. per acre were applied to sugar beets after blocking and thinning. The beets were 6-10 inches in height and contained some broad-leaved and grass weeds.

All compounds were applied in 40 gallons of water per acre on three replications and carried to harvest for yield and sugar content data.

The endoxyhexahydrophthalate treatments caused severe spotting of beet leaves and defoliated broad-leaved weeds. Grass seedlings, in 2-4 leaf stage, were killed but older grasses were not affected. E. C. 5722 produced no effects on beets or weeds.

IPC treatments caused a marked epinastry of beet leaves, the petioles became white, brittle, and many of the leaves died. New leaves, formed late in the season, were dwarfed and had crinkled margins, almost like kale leaves. Tonnage and sugar content were not reduced by the treatments. (Contribution from Mich. Agric. Exp. Station and Weed Div. BPIS and AE., U.S.D.A.)

Pre-emergence treatments for weed control in sugar beets. Grigsby, B. H. Applications of several herbicides were made two days prior to emergence of sugar beets. Ten chemicals at two or three rates were used and three replications of each rate were made. Chemicals and rates per acre were as follows: TCA, 10, 15 and 20 pounds, Chlorosol-A, 10, 15, and 20 pounds, IPC, 4, 8, and 16 pounds, Xanthogen disulfide, 5, 10, and 20 pounds, Aromatic oil, 20, 40 gallons, E. H. # 2, 2, 4, and 8 pounds, Maleic hydrazide, 2 and 4 pounds, DN (Premerge) 1, 2, and 4 pounds and PCP, (Na salt) 8, 16 and 20 pounds.

Treatments were evaluated by determinibg the effects on beet stands, weed counts, yield of beets and sugar content. Beet stands equal to 75%, or more, of check were obtained with all rates of TCA and IPC, Xanthogen disulfide at 5 pounds, oil at 20 gallons, E H # 2 and Maleic hydrazide at 2 pounds and PCP at 8 pounds. A 75% reduction in weed count was obtained with TCA, Aromatic oil, Maleic hydrazide and PCP.

PCP, dinitro, aromatic oil, maleic hydraxide, 4 pounds, chlorosol-A and Xanthogen disulfide caused more than 25% reduction in beet yield. Reduction in sugar content was found only in the dinitro and PCP treatments.

TCA, IPC, E H # 2, maleic hydraxide and lower rates of PCP appear to be suitable for limited field scale trials. (Contribution from Michigan Agricultural Experiment Station and Division of Weed Investigation, Bureau of Plant Industry Soils and Agricultural Engineering, U. S. Dept. of Agriculture.)

Test of herbicides for selective chemical weeding of sugar beets. Nelson, Russell T. Herbicides including Formula 5722 (Carbide and Carbon Chem. Co.), IPC, Endothal, Chlorosol-A, diethanolamine salt of maleic hydrazide, TCA, Na salt, dichloral urea, 2,4-dichlorophenyl "cellosolve" sulfate, N.I.X. (sodium isopropyl-xanthate), PMC (polychloro aryl alkyl carbonate), and polybor-chlorate were tested as post-emergence applications on sugar beets. Those herbicides and rates which, in one test at Longmont, Colorado, 1950, appeared promising enough to warrant further testing are: Formula 5722, 4 lbs. active ingredient per acre; IPC, 10 lbs. per acre applied dry; Endothal, 3 lbs. per acre; TCA, Na salt, 8 lbs. per acre; and dichloral urea, 25 lbs. per acre applied dry. Herbicides not applied dry were sprayed over beets and weeds using a rate of 40 gallons water per acre. Practically no contact injury to beets was noted from the treatments and rates given above. A certain amount of chronic toxicity to beets occurred on all listed treatments, but was of short duration and did not visibly affect yield. None of the treatments tolerated by beets gave more than partial weed control. Supplementary cultural practices were employed, after a period of observation, to grow the crop. (Contribution from Agr. Exp. Sta., The Great Western Sugar Co., Longmont, Colorado.)

Effect of several herbicides as pre-emergence treatments for weed control in sugar beets. Swanson, C. R. and E. A. Helgeson. Sugar-beet plots were sprayed just prior to emergence of the crop using four replications of each treatment. Soil moisture conditions were unfavorable for germination and sugar-beet emergence was poor. Of the several chemicals used, TCA was the only one which gave practical control of yellow and green foxtail (Setaria lutescens and S. viridis). TCA was applied at 10, 15 and 20 pounds per acre as the sodium trichloroacetate. Pigeon grass stand was about 15% of that of control plots at all rates of application but wild oats were not affected. Sugar beets were largely unaffected by 10 and 15 lbs.

but showed some mottling of the leaves at 20 pounds. Grass weed stand was reduced slightly by endoxohexahydrophthallate (EC 3740) without injuring sugar beets but practical control was not obtained using rates of 1, 2 and 4 pounds per acre. The alkanolamine salt of dinitrophenol at 3, 6 and 9 qts. per acre reduced the stand of annual grass and broad-leaved weeds but almost eliminated sugar beets. Methoxone and several 2,4-D formulations were more injurious to beets than to weeds. IPC at rates up to 8 pounds per acre both as pre-plantings and pre-emergence treatments had no noticeable effect on beets or weeds. Other chemicals ineffective in controlling weeds in sugar beets were xanthogen disulfide, dichloral urea, and polychloro aryl-alkyl carbamate. (Contr. Div. of Weed Investigation, BPISAE, U. S. Dept. of Agric. and N. D. Agr. Exp. Sta.)

Post-emergence weed control investigations in sugar beets. Swenson, C. R. and E. A. Helgeson. Post-emergence application of four chemicals was made after blocking and thinning at which time the beets were in the 4 to 6 leaf stage. By this time annual grass weeds were 8 to 10 inches tall. Endoxohexahydrophthallate (EC 3740) burned the grass weeds at 2 and 4 pounds per acre but they later recovered. EH 5722 at 1, 2 and 4 pounds per acre and dichloral urea (EH2-73) at 2, 4 and 5 pounds per acre had no effect on beets or weeds. Maleic hydrazide applied at 2, 4 and 8 pounds per acre suppressed further growth of grass weeds at the two higher rates but killed most of the sugar beets. (Contr. Div. of Weed Investigations, BPISAE, U. S. Dept. of Agric. and N. D. Agr. Exp. Sta.)

Screening test rating of new herbicidal chemicals when applied as pre-emergence treatments on sugar beets and annual weeds. Brookings, S. D., 1950. Stahler, L. M., James Hay, D. E. Kratochvil and L. A. Derscheid. Twenty-one chemical formulations of unknown herbicidal qualities were applied 2 days prior to emergence of beet seedlings and before emergence of annual weeds. Beets were planted in rows. Chemicals were applied at several rates as water spray solutions. Endothal (Sharples Chem. Co.) was the only material which gave satisfactory control of grass weeds without injury to beets. It gave no control of broad-leaved weed seedlings at rates of 2, 4 or 6 pounds per acre. IPC at rates of 4, 8 or 16 pounds, as surface application. or disced into the soil, gave poor control of grass weed seedlings; had no effect on beets or broad-leaved weeds. Sulfasan (Monsanto) or Cyannate (Am. Cyanamid) gave no measurable control of weed seedlings; no injury to beets. Promerge (Dow) at 3, 6 or 9 qts. per acre eliminated beets with poor control of weed seedlings. Maleic hydrazide at 8 or 16 pounds markedly injured beets; gave no effective weed control. E.H. 2 (Carbide & Carbon) only partially controlled grass seedlings; showed no effect on beets or broad-leaved weeds. All 2,4-D formulations or derivatives gave fair control of grass and broad-leaved weeds; seriously impaired stand and growth of beets. E.C. 3890 (Sharples) showed some promise in control of weed seedlings; slightly reduced vigor of beets at most effective levels. Other chemicals tested showed little possibility of use in beets weed control. (Contri. of Agronomy Department, South Dakota State College, & Bureau of Plant Industry, Soils and Agricultural Engineering, U.S.D.A.)

Screening test rating of new herbicidal chemicals when applied as post-emergence treatments on sugar beets and annual weeds. Brookings, S. D., 1950. Stahler, L. M., James Hay, D. E. Kratochvil, L. A. Derscheid. Fourteen chemical formulations of unknown herbicidal qualities were applied to sugar beets when the beets were in the 4 leaf stage and grass and broad-leaved seedlings were well emerged. Chemicals were applied at several rates as water spray solutions. Of the materials tested, only Endothal (Sharples Chem.) at 2, 4 or 6 pounds per acre gave a measurable con-

trol of grass weeds and at 6 lbs. per acre markedly reduced growth of beets. This material gave no control of broad-leaved weeds. E.H. 5722, E.H.#2, E.H. 5678, E.H. 5665, E.H. 5669, E.H. 568 (Carbide & Carbon) had little or no reaction on beets; gave no measurable control of either grass or broad-leaved weed seedlings. In earlier greenhouse tests all of these materials showed some promise for selective control of weeds in beets. E.C. 3890 and ME. 3001 gave no reaction on beets; showed some degree of control of grass weeds and should be further tested at rates above those used in this test. Dow-A 548, Dow-H 1010 and an amine salt of 2,4-D, each at ¼ or ⅓ lb. per acre, used here to determine the relative phytotoxicity of the three materials, indicated that the low volatile ester was most severe in its action, the amine second, and the 2, methyl-4-chlorophenoxyacetate least severe in its action on beets. All of these materials gave excellent control of broad-leaved weeds, no measurable control of annual grasses; and all injured beets beyond the level of commercial possibilities in use: Maleic hydrazide at 4 or 8 pounds per acre completely eliminated beets with only moderate reduction in growth of annual grasses and broad-leaved weeds. (Contr. of Agronomy Dept., S. D. State College, & Bur. of Pl. Ind., Soils & Agricultural Engineering, U.S.D.A.)

Pre-emergence chemical control of weeds in sugar beets. Taylor, Clifford E. Sugar beets were planted June 6, on sandy, clay-silt loam. Treatments were applied June 9, with emergence June 12-18, and harvest October 12. Treatments included TCA, Na salt, at 4, 8 and 12 pounds, 2,4-D, Na salt, at ½ pound (eq/a) and KOCN at 15 pounds, all in 100 gallons of water per acre, Stoddard solvent, at 60 gallons, fortified with PCP at 4 pounds per acre, plus unsprayed checks. There were no weeds present at time of treatment. The soil surface was dry, temperature 86° F. For the week prior to treatments the mean temperature was 69°F. and the rainfall: 6/2 - 2.35". For the two weeks following treatments the mean temperature was 67°F. and the rainfall: 6/9 - 0.74", 6/13 - 1.10", 6/15 - 0.36", 6/17 - 0.79", 6/18 - 1.12", 6/19 - 0.01" and 6/24 - 2.31". The weeds were quite varied in both kinds and numbers through this experiment, and consisted mostly of pigweeds (Amaranthus srs.), annual grasses, purslane (Portulaca oleracea), lamb's quarters (Chenopodium album) and buttonweeds (Malva rotundifolia). There was no significant control of total weeds, after four weeks, from any treatment. However, control of the grasses was excellent at all three rates of TCA. The 2,4-D at ½ pound per acre very significantly reduced in number and increased in average weight per beet, with the ton per acre yield being lowered, but not to a significant degree. There was no significant effect on the stand, yield or average weight per beet from any of the other treatments. (Contribution of the Illinois Agric. Exp. Sta., Urbana, Illinois.)

Herbicides on sugar beets. White, W. W., and Willard, C. J. Test conducted near Green Springs, Ohio, on two soil types, a glacial sandy beach ridge and a level, heavy, black, glacial lake-plain soil. Randomized block test, with a check adjacent to every treated plot, 3 replications. The materials tested, rates used, (All applied as pre-emergence except C & C 5722) and notes on their behavior, follow: — TCA, Na salt, 5,10, 15, and 20 lb. per acre. This did an excellent job of controlling grasses at 10 lb. per acre, and appeared not to have affected beet growth. PCP in diesel oil, 4, 8, and 12 lb. per acre of PCP/ Excellent at times, killed beets at times. Too erratic for recommendation. PCP in aromatic oil, applied in water at same rates, less effective than PCP in oil spray but otherwise the same. Sodium PCP, 5,10,and 15 lb. per acre. Erratic; killed more beets than weeds. Triethanolamine salt of DNOSBP killed beets before weeds, especially on sandy soil. Not safe. Xanthogen disulphide; erroneously used at 1/5 intended rates at Green Springs. A special test of 30 plots and 12 checks, half irrigated, half not, was planted at Columbus June 29, treated July 3, rates 5 to 15 lb. per acre. For the most part, no

effect on weeds or beets. In some, at rates higher than recommended, beets injured more than weeds. Definitely not satisfactory. Sharples E.C. 3740. Ineffective at rates used (2 to 8 lb. per acre). C & C 5722, 2 to 8 lb. per acre, (post-emergence, beets two leaf stage). Ineffective on weeds or beets. Slight leaf burning of both at 8 lbs. Dichloral urea (E.H. No. 2), 1½ to 3 3/4 lbs. per acre. Two plots fair at highest rate, some damage to beets. Might be tried again at higher range of rates. (Contribution of Ohio Agricultural Experiment Station.)

Pre-emergence weed control in sugar beets. Wilson, J. D. Sugar beets were planted May 27 in Brookston clay soil four miles southwest of Fremont, Ohio. On May 29 four plots, four rows wide and 750 feet long were sprayed with two formulations of each of two herbicides. Plots numbers one and two were next to an air strip and suffered some from water draining from the strip. Sulfasan at one gallon per acre was applied to Plot #1. Sulfasan at two gallons per acre to Plot #2, pentachlorophenol (Santophen 20) in aromatic oil at five gallons per acre to Plot #3 and pentachlorophenol (Santophen 20) in diesel oil at five gallons per acre to Plot #4. Checks were laid out adjacent ot the treated plots. All applications were made with a self-propelled wheelbarrow sprayer. The formulations were applied in fifty gallons of water to the acre. Weed control in all plots was better than 90% with plots 3 and 4, slightly better than 1 and 2. At harvest, the average stand count of the sprayed plots was 12% greater than the checks. Yields of all sprayed plots exceeded the checks. The best plot, Sulfasan at one gallon per acre, yielded 21.6% more beets than the average of the checks. (Contribution of the Ohio Agricultural Experiment Station in cooporation with H. E. Brunor, Monsanto Chemical Co.)

PROJECT IV. CONTROL OF WEEDS IN VEGETABLE CROPS, POTATOES, SUGAR BEETS, SMALL FRUITS AND ORNAMENTALS.

Vegetable Crops and Potatoes — G. F. Warren

SUMMARY

Abstracts received covering herbicidal studies with vegetables during the 1950 season included 27 reports on onions, ten on red beets, nine on potatoes, eight on sweet corn, seven each on vine crops and Umbellifers, six on spinach, five on beans, four each on peas and tomatoes, three each on asparagus and lettuce and one each on sweet potatoes, horseradish, turnips and chard.

Onion crop injury has occurred on occasion from the pre-emergence use of 2,4-D at a one pound rate, with consistent safety reported at a half pound. Pre-emergence 2,4-D usage in onions is more successful in less porous and high organic soils, and with deep planting, applications just before onion emergence, and the use of salt formulations. Onions from sets are more resistant to herbicidal treatments than onions from seed. Encouraging new materials include 3,6-endoxohexahydrophthalate (E.C. 3504, 3740 and M.E. 3003) and salts of tri-, tetra- and ortho-phenylphenol. Certain oils, dusting grade calcium cyanamide, dilute sulfuric acid and KOCN (potassium cyanate) have shown some degree of control of emerging (or emerged) weeds before onion emergence. As pre-emergence herbicides in onions ethyl xanthogen disulfide, NIX (sodium isopropyl xanthate), polychlorinated phenols, dinitros, TCA (trichloroacetic acid), IPC (isopropyl-n-phenyl carbamate), maleic hydrazide, C.C. 5475 and 5673, E.H. 1 (sodium-2,4-dichlorophenoxyethyl sulfate) and E.H. 2 (dichloralurea) all have shown either none or no consistant balance between weed control and stands and/or yields of onions.

As post-emergence treatments in onions, results with NaCl, dinitros, PCP, KOCN and dilute sulfuric acid have been good at times, but natural environment affects the reaction of the weeds and the onions to the chemicals to such a degree that effective rates of application are variable and critical. The reports indicate that treatments must vary from lower concentrations on more succulent onions (and weeds) to higher rates on hardened growth, to achieve satisfactory balance between weed control and onion injury. Onion seedlings appear less resistant at the "flag" stage. Annual weeds must be small to be killed. 2,4-D, xanthogen disulfide, the tri- and tetra-chlorophenates, E.H. 5722 and various oils were unsatisfactory when sprayed over the onion foliage.

The reports continue to show satisfactory pre-emergence use in potatoes of the dinitros and pentachlorophenols and also 2,4-D up to 2 pound rates except for susceptible varieties at the higher rates under some conditions. Other favorable pre-emergence treatments included xanthogen disulfide, 3,6-endoxohexahydrophthalate and $PECX_3$, with TCA and E. H. 1 and 2 not giving adequate weed control at the rates reported. Varietal differences apparently influence success in the post-emergence usage of 2,4-D in potatoes. Most varieties have shown temporary to permanent formative effects after post-emergence 2,4-D treatments. One abstract reports intensified periderm color in proportion to injury from 2,4-D and MCP.

The pre-emergence usage in sweet corn of 2,4-D up to 2 pounds and the dinitros and PCP continue to be quite effective. Ample moisture and application

not too close to actual emergence favor results in pre-emergence dinitro treatments. Post-emergence applications at contact 2,4-D rates have not been reducing sweet corn yields, but stalk abnormalities and lodging continue to be problems.

Pre-emergence applications in asparagus show that dinitros have caused injury at the base of the spear in two locations, with one report of the same injury from Na-PCP. Another report shows no injury from either material and also effective usage of 2,4-D at pre-emergence rates.

Pre-emergence weeding of carrots was encouraging with TCA and NIX but unsatisfactory with Varsol (in Canada) and 3,6-endoxohexahydrophthalate. Post-emergence use of Varsol was not satisfactory on carrots, parsnips and celery. At one location using three rates of Stoddard solvent carrot yields were reduced at the two higher rates, celeriac at all rates but there was no injury to parsnips and celery.

In red beets using pre-emergence treatments, encouraging results have been obtained with TCA from 8 to 20 pounds, and (single reports) PCP at 2 pounds combined with TCA, Varsol, 3,6-endoxohexahydrophthalate and NIX. Use of PCP at 4 pounds or higher, dinitros, 2,4-D, E.H. 2, IPC, KOCN and Stoddard solvent have been reported as unsatisfactory, with the use of 5722 and xanthogen disulfide questionable. One report indicates that yields were satisfactory after the post-emergence use of 5722 at 2 and 4 pounds and TCA at 4 and 8 pounds, but unsatisfactory with Stoddard solvent and KOCN.

Pre-emergence treatments of dinitros have given good results on snap and lima beans while results have been erratic with PCP and xanthogen disulfide. Use of 2,4-D at ½ pound is questionable, and unsatisfactory at higher rates, or when applied post-emergence, with formative effects, floral abscission and reduced yields being noted. Lima bean variety Henderson appears more resistant.

In peas the pre-emergence use of calcium cyanamide and dinitros have been satisfactory, but 2,4-D and PCP are questionable. Single reports indicate XP-40A as unsatisfactory and E.H. 1, NIX and xanthogen disulfide as satisfactory. One report on the post-emergence use of 2,4-D in peas showed questionable to unsatisfactory results.

In pre-emergence weeding of vine crops xanthogen disulfide, PCP and low rates of dinitros were satisfactory on some of these crops but not on others. One report indicates good control of crabgrass in muskmelons with post-emergence treatments of dichloralurea and N-1-naphthyl phthalamic acid.

Pre-emergence weeding was encouraging in direct-seeded tomatoes with PCP, NIX and TCA at 2 pounds alone and in combinations, in horseradish with dinitros and PCP, in spinach with NIX, 3,6-endoxohexahydrophthalate and Varsol and in lettuce and turnips with Varsol. Crabgrass was controlled in sweet potatoes with N-1-naphthyl phthalamic acid. Post-emergence spraying with shields over the crop row was reported for beans and onions.

Peas, onions, and carrots showed resistance to maleic hydrazide, with beets, chard, spinach, vine crops, tomatoes, potatoes and lettuce showing slight to severe retardation of growth, and/or foliar abnormalities.

Abstracts of Results of Cooperators

Pre- and post-emergence weed control with onions on muck soils. Alban, E. K. and Alley, Lester. During the 1949 and 1950 seasons, pre-emergence treatments with xanthogen disulfide at 25 lbs.; PCP at 5, 10 and 12 lbs.; and Stoddard Solvent (12 to 18 per cent aromatic) at 50, 80 and 100 gals. per acre rates, were applied just prior to emergence of onions. Post-emergence treatments with 1.0, 1.5, 2.0, and 2.5 per cent KOCN; 0.5, 0.75, 1.0, and 2.0 per cent SPCP; and Carbide Chemical No. 5722 at 4 lbs. were applied at 50 or 80 gals. per acre at various intervals from time of emergence of onions to within two weeks of harvest. All plots were cultivated as needed, but only the hand-weeded checks and the pre-emergence treatments were hand-weeded regularly. A randomized split block with five replications was used in both seasons, with Brigham Yellow Globe and Sweet Spanish varieties being included in the 1949 season but only Brigham Yellow Globe in the 1950 season. None of the post-emergence treatments compared favorably with the hand-weeded checks. KOCN and Carbide Chemical No. 5722 did not control weeds, and with the exception of the two lower rates of KOCN, resulted in mild to severe damage to the onions in both seasons. Good to excellent control of all weeds was obtained with all four SPCP sprays, but the damage to onions was excessive in both seasons. Stoddard Solvent at all three rates produced the most consistent weed control with none to only slight damage to onions. Xanthogen disulfide was used only during the 1949 season and compared favorably to Stoddard Solvent. PCP treatments varied from mild to severe damage to onions in both seasons, with good to excellent weed control. The major value noted with successful pre-emergence treatments was the elimination of one hand-weeding and the ease of first cultivation as compared with hand-weeded check. (Ohio Agr. Exp. Sta.)

Pre-emergence weed control with potatoes on muck and upland soils. Alban, E. K. During the 1948, 1949 and 1950 seasons, Irish Cobbler, Katahdin, Chippewa and Russet Rural varieties of potatoes were grown on muck soils, and Wooster silt loam, Brookston silt loam and Miami silt loam. Pre-emergence chemical weed control treatments were applied at various intervals from time of planting to just prior to emergence of the potatoes. Chemicals with per acre rates included; 2,4-D at 1.0, 1.5, and 2.0 lbs. (acid equiv.) of alkyl ester, sodium salt, and polypropylene glycol butyl ether ester; xanthogen disulfide at 15.0, 20.0, and 25.0 lbs.; DNOSBP at 10.0 lbs.; SPCP as a 3.0 per cent solution; and PCP at 5.0, 10.0 and 16.0 lbs. Not all of the above mentioned variables were included on all soil types or for every season. DNOSBP at 10.0 lbs.; PCP at 10.0 and 16.0 lbs.; and SPCP as a 3.0 per cent solution applied just prior to emergence of Irish Cobbler and Katahdin potatoes, on muck soil, produced excellent weed control which was comparable or slightly superior to check plots which had a spike tooth weeder treatment. There was no evidence of damage to either variety and no significant difference in yield. Xanthogen disulfide did not damage Irish Cobbler or Katahdin potatoes but weed control was very poor as compared with the check. Application of 1.0 and 2.0 lbs. alkyl ester of 2,4-D and 2.0 lbs. sodium salt of 2,4-D on Irish Cobbler, Katahdin, Chippewa and Russet Rural, 10 days after planting and before emergence of potatoes has never resulted in damage to potatoes and weed control has been excellent, on upland soils. However, when the same rates or slightly higher rates are applied at time of planting or just at emergence of potatoes, poorer weed control follows the former and increased evidence of damage to plants is apparent with the latter. This damage is particularly striking with the variety Russet Rural, and usually resulted in lower yields. Control of crabgrass and foxtail is obtained with the ten day treatment and very seldom obtained with either the earlier or the later 2,4-D treatment.

The polypropylene glycol butyl ether ester of 2,4-D at 1.5 lbs. on Irish Cobbler and Katahdin just prior to emergence of potatoes on muck soils resulted in some mild symptoms of 2,4-D damage, but potatoes recovered and excellent weed control was obtained. (Ohio Agr. Exp. Sta.)

Pre-emergence herbicides in vegetable crop production. Alban, E. K. During the last four years, 26 kinds and approximately 100 varieties of vegetables have been included in pre-emergence chemical weed control studies in the field and in the greenhouse under various environmental conditions. Muck, and silt loam to clay loam soils were the major soils included in these studies. The major chemicals were: 2,4-D (esters, amines, and sodium salt); IPC; STCA; PCP; SPCP; KOCN; DNOSBP; ADNOSBP; TADNOSBP; ethyl xanthogen disulfide; calcium cyanamide; aromatic oils, varying from 10 to 18 per cent aromatic content; and diesel fuel combined with PCP or DNOSBP. Based on weed control and crop tolerance, the following evaluation of the herbicides studied under Ohio conditions are presented. Pre-emergence treatments with 2,4-D have been consistently successful with only potatoes, sweet corn, and asparagus. PCP, SPCP, DNOSBP, ADNOSBP, TADNOSBP, calcium cyanamide, and diesel fuel combinations with PCP or DNOSBP, cannot be safely used as a pre-emergence treatment on such crops as carrots, beets, onions, cabbage, cauliflower, broccoli, parsnips, lettuce, endive, turnip, tomato, and radish. The latter group of chemicals can be used with some degree of safety as a pre-emergence treatment on the large-seeded crops such as lima and snap beans, peas, sweet corn, cucumbers, muskmelons, potatoes, and asparagus plants. Ethyl xanthogen disulfide has produced such variable results and weed control has in general been so inadequate that it cannot be recommended. KOCN and aromatic oils have produced the most consistent, safe weed control measure used as a pre-emergence contact spray on such crops as onions, spinach, beets, carrots, tomatoes, turnips, endive, lettuce, and direct-seeded asparagus. Both of these chemicals have proven extremely valuable as a pre-emergence contact spray on small- and large-seeded vegetable crops where emergence of weed seedlings allowed spraying before emergence of crop seedlings. IPC and STCA would appear to have a limited application as pre-emergence sprays for vegetables. Specificity of IPC for purslane suggests its use as a lay-by treatment for onions, asparagus, potatoes and sweet corn. STCA and IPC could also be considered as an emergency measure for control of small annual grasses in asparagus. (Ohio Agr. Exp. Sta.)

The use of Aero Cyanate (potassium cyanate) as a herbicide in onions. Andersen, E. T. and Shadbolt, C. A. Applications of Aero Cyanate at 8, 16, 24, and 32 lbs. per acre rates were made to Ebenezer onions grown for Dutch set production. A wetting agent (Nonic 218, Sharples Chems. Inc.) was applied with one set of treatments. Application was made while the onions were in the crook stage. Weeds present at the time of treatment were mustard (Brassica arvensis), stinkweed (Thlaspi arvensis), wild buckwheat (Polygonum convolvulus), and great ragweed (Ambrosia trifida) all in the two-leaf stage, and wild oats (Avena fatua) and perennial sow thistle (Sonchus arvensis), also in small stages. Differences between treatments without and with the wetting agent were very slight. The 16 lb. treatment gave a satisfactory control of mustard, stinkweed, and wild buckwheat, the latter being the most resistant. Wild oats and sow thistle were resistant to all rates. Great ragweed was controlled only at the 24 and 32 lb. rates. At harvest time, the yields of onions from the 16 lb. treatments compared favorably with the yields from the 24 and 32 lb. rates, and with the cultivated checks. This was in agreement with the weed count records which showed little additional advantage to be gained from the higher rates. (Plant Science Division, The University of Manitoba, Winnipeg.)

Pre-emergence treatment of onions. Bakke, A. L. and Staniforth, D. W. Onions of the Iowa Yellow Globe variety were planted on May 11 on heavy peat soil in northern Iowa and were given pre-emergence treatments on May 19 involving the following treatments: C.C. 5475, 2, 4 and 8 lbs. per acre, E.H. No. 1, 2, 4 and 8 lbs., C.C. 5673, 4 and 8 lbs., 2,4-D (amine) 1 and 2 lbs., 2,4-D (ester) 1 and 2 lbs., 2,4-D (acetanalide) 1 and 2 lbs.; Dow Premerge, 3 lbs., fuel oil No. 2, 50 gals. per acre. On June 7 it was found that the best results were obtained with C.C. 5475, 2 lbs. per acre; 2,4-D (amine), 1 lb.; 2,4-D (ester), 1 lb., 2,4-D (acetanalide), 1 lb. The onions at the time were slightly stunted and the weeds were small. The heavier applications produced better weed control but at the same time caused more injury to the onions. The total yields for the 2-20 foot rows 4 replications were as follows: Control 255 lbs.; 2,4-D (ester) 221 lbs.; 2,4-D (acetanalide) 235 lbs. The respective stands were accordingly 1260, 1262, 1365, 1223, 1158. (Iowa Agricultural Experiment Station.)

The effects of Disodium 3,6 Endoxohexahydrophthalate on weeds and various vegetable crops. Barnard, E. E. Jr. and Warden, R. L. 3,6-E (E.C.-3740) was applied to randomized four replicated plots of Dark Red Detroit beets, Tendersweet carrots, Straight Eight cucumbers, New York No. 12 head lettuce, Yellow Globe onions (sets), and King of Denmark spinach one week after seeding. Near optimum germination conditions prevailed for three weeks after planting on May 25. At the time of treatment the spinach and lettuce were about 10% germinated and the onions were about 40% sprouted. Six-tenths of an inch of rain fell during the week following application and before complete emergence. Stand counts of weeds and vegetables were made four weeks later. Thereafter, the weeds were suppressed mechanically and the plots were thinned, sprinkler irrigated, and maintained with normal gardening practices. Weeds (red root pigweed, fanweed, wild mustard, and particularly Setaria spp.) were suppressed about 50% and 70% by treatments of 2 and 4 lbs. per acre respectively. Beets and cucumbers exhibited stands approximating those of the check plots. Spinach stands were 145% and 127% of the check at 2 and 4 lbs. respectively. Lettuce and carrots had stands of 60% and 51% at the 2 lb. rate and 44% and 24% at the 4 lb. rate, which were highly significant reductions. Yields of onions and spinach were nearly the same as the check plots, whereas beets yielded 113% and 123% at 2 lbs. and 4 lbs. per acre, the latter being a significant increase. Cucumbers, lettuce and carrots yielded 74%, 38% and 61% with the 2 lb. treatment, and 34%, 15% and 30% with the 4 lb. treatment. All, except the cucumber yield at 2 lbs. per acre, were highly significant reductions. A bolting increase in lettuce was noted with the check bolting 2%, the 2 lb. rate 15%, and the 4 lb. rate 30%. Cucumber plots receiving 2 lbs. per acre were approximately one week later while those receiving 4 lbs. per acre were from 1½ to 2 weeks later than the checks. (Montana Agricultural Experiment Station.)

The effects of Sodium Isopropyl Xanthate on weeds and various vegetable crops. Barnard, E. E. Jr. and Warden, R. L. Goodrite NIX was applied to randomized, four replicated plots of Dark Red Detroit beets, Tendersweet carrots, Straight Eight cucumbers, New York No. 12 head lettuce, Yellow Globe onions (sets), and King of Denmark spinach one week after seeding. Near optimum germination conditions prevailed for three weeks after planting on May 25. At the time of treatment the spinach and lettuce were about 10% germinated and the onions were about 40% sprouted. Six-tenths of an inch of rain fell during the week following application and before complete emergence. Stand counts of weeds and vegetables were made four weeks later. Thereafter, the weeds were suppressed mechanically and the plots were thinned, sprinkler irrigated, and maintained with normal gardening practices. Only a 15-pound (active ingredient) per acre rate of application was made due to the excessive foaminess of the material supplied for the

remaining rates of application. Weeds (red root pigweed, fanweed, wild mustard, and Setaria spp.) were suppressed about 60% by this treatment. Beet, carrot, cucumber and onion stands approximated those of their checks, whereas spinach exhibited a 25% increase and lettuce a 21% reduction. The yield of onions was nearly the same as its check, while beet and carrot yields were 10% and 9% higher than theirs. Cucumber, spinach and lettuce yields were reduced 9%, 14% and 26%. The stand and yield reductions for lettuce are significant at the 5% level. (Montana Agricultural Experiment Station.)

The effects of various herbicides on weed control, stands and yields of Netted Gem potatoes. Barnard, E. E. Jr. and Warden, R. L. Netted Gem potatoes were planted in randomized, three replicated plots on May 16. Near optimum germination conditions prevailed for four weeks after planting. On June 1, the following pre-emergence sprays were applied: 3,6-E (E.C.-3740), 2 and 4 lbs. active ingredient per acre; 2,4-D (Sodium 2,4-dichlorophenoxyacetate) 1 and 2 lbs. acid equivalent per acre; Premerge 4 and 6 pounds active ingredient per acre. Stand counts of weeds and potatoes were made June 26. Thereafter, the weeds were suppressed mechanically so that differential herbicidal effects could be measured, and the plots were sprinkler irrigated and maintained with normal practices. On June 26 Maleic Hydrazide was applied at .1% and .5% active ingredient in 50 gals. of water per acre. At this time emergence had been completed for about two weeks. Weeds (red root pigweed, fanweed, wild mustard, and Setaria spp.) were suppressed by the treatments as follows: 3,6-E, 2 lbs., 55%; 4 lbs., 71%; 2,4-D, 1 lb., 72%; 2 lbs., 91%; Premerge, 4 lbs., 84%; and 6 lbs., 86%. The potato stands for all treatments approximated those of the check. Yields of No. 1 potatoes for all treatments except Maleic Hydrazide approximated those of the check. Maleic Hydrazide depressed yields at the .1% rate 12%, and at the .5% rate 83%, the latter being highly significant. At the .1% rate it slightly increased tuber set and slightly reduced tuber size. At the .5% rate set was increased 124% and size of No. 1's was lowered 45%. On a size basis, 65% of the tubers of the check were No. 1's, whereas at the .5% rate only 8% were No. 1's. Many second growths and many aerial tubers developed at the .5% rate. (Montana Agricultural Experiment Station.)

The effect of Maleic Hydrazide on various vegetable crops. Barnard, E. E. Jr. and Warden, R. L. Maleic Hydrazide was applied to randomized, four replicated plots of Dark Red Detroit beets, Tendersweet Carrots, Straight Eight cucumbers, New York No. 12 head lettuce, Yellow Globe onions (sets), and King of Denmark spinach. Near optimum germination conditions prevailed for three weeks following planting on May 25. Applications of .1% and .5% active ingredient in 50 gals. of water per acre were made on June 26, at which time germination had been completed for a week. Clear weather followed application for seven days. Since the effect of the material on the crops was the object of this experiment the weeds were suppressed mechanically and the plots were thinned, sprinkler irrigated, and maintained with normal gardening practices. Beet and spinach yields at the .1% rate and onion and carrot yields at both rates were nearly the same as those of the check plots. Cucumber yields were 75% and 70% of the check at the two rates but the reduction is not significant. Highly significant yield reductions occurred at the .1% rate with 34% in lettuce, and at the .5% rate with 35% in beets, 76% in lettuce, and 55% in spinach. A bolting increase in lettuce was noted with the check showing 2% bolting, the .1% rate 13% bolting and .5% rate 68%. In addition, the lettuce from the .5% rate exhibited leathery, distorted, outer leaves. The material caused slight tip burn and stunting on spinach at the .1% rate and much tip burning and stunting at the .5% rate. Cucumber plots receiving the .1% rate were delayed approximately 1/2 to 1 week while those receiving the .5% rate were 1 to 1½ weeks later than the check. (Montana Agricultural Experiment Station.)

The selective post-emergence control of weeds in onions. Bruner, H. E. When Yellow Globe onions being grown on muck at Celeryville, Ohio, had reached the stage where the older leaves were beginning to fall over, purslane infested the area to the point where a portion of the acreage was about to be abandoned. Chemical weed control was begun on the most severely infested block of 4.7 acres. A special boom was rigged on a Bean sprayer so that by spraying through the row from each side, the spray could be applied to the row only in a band approximately 8 inches wide. The fan type nozzles were adjusted to deliver the spray forward and downward from a height of not more than two inches. The herbicide used was a special formulation of Sulfasan which had been found in earlier small scale tests to control purslane while having no more than a slight temporary effect on the onions. Applications were made at pressures ranging from 5 to 40 lbs. and at gallonages ranging from 50 to 200 gals. per acre. The best results followed the application of 10 lbs. of straight Sulfasan in 150 gals. of water to the acre at 10 lbs. pressure. A high degree of purslane kill was secured, no acreage was abandoned and yields ran between 1,000 and 1,200 bu. to the acre. (Monsanto Chemical Company).

Effects of three herbicidal oils on carrots and pigweeds. Corns, W. G. Phytotoxicity of three experimental Imperial oils were compared at three rates in triplicate using carrots with lamb's quarters and red root. Oil 1: Lab. No. Q x R - 155 C., distillation range 527 - 600°F., approximately 20% aromatics; Oil 2: Lab. No. Q x R - 155 A., distillation range 440 - 690°F.; Oil 3: Lab. No. Q x S - 16 C. distillation range 330 - 640°F., 76% aromatics. Carrots sprayed in 2-4 leaf stage, 3-5 inches tall, and weeds in rosette to 6 inches tall. Oil 1: 40, 70 and 100 gals. per acre. Oils 2 and 3: 20, 40 and 60 gals. per acre. Estimated final damage to weeds were: Oil 1, 40 gals.: 25 and 60% as regards large and small weeds respectively, 70 gals.: 40 and 90%, 100 gals.: 70 and 100%. Oil 2, 20 gals.: 40 and 80%, 40 gals.: 60 and 100%, 60 gals.: 90 and 100%. Oil 3, 20 gals.: 60 and 90%, 40 gals.: 70 and 100%, 60 gals.: 90 and 100%. Fresh weights of carrot tops or of roots showed interesting similarity regarding reduction applicable to both determinations. Oil 1: approximately 20, 40 and 60% reduction as compared with unweeded check, Oil 2: 35, 50 and 60%, Oil 3: 40, 50 and 60%, corresponding to increasing rates of application. Evidently 70 and 100 gals. per acre of Oil 1, though slower acting, were approximately equivalent to 40 and 60 gals. per acre of Oils 2 and 3 regarding carrot and weed damage. Herbicidal rates of all three oils were insufficiently selective. (Dept. Plant Science, Univ. of Alberta.)

DNOSBP for residual pre-emergence weed control in established asparagus beds. Coulter, L. L. Pre-emergence applications of DNOSBP as the triethanol amine salt at rates from 6 to 20 lbs. per acre were made on three beds of asparagus established on sandy soils. Treatments of 9 lbs. or more gave acceptable control of broad leaf weeds for a period of 4 - 6 weeks, however, 12 lbs. gave complete control of all weeds including crabgrass for a period of 6 weeks. Slight injury occurred near the base of the spears in two fields, but this did not appear to be of such a nature as to materially affect the yield of marketable spears. This injury occurred following a light rain during a period of cold weather and arrested growth. Lower rates of DNOSBP may be suitable for this crop on different soils or where annual grasses are not a problem. (The Dow Chemical Company, South Haven, Michigan.)

Onion weed control with chemicals. Denisen, E. L., Staniforth, D. W. and Bakke, A. L. A split plot experiment of five replications combined pre-emergence and post-emergence treatments on Iowa Yellow Globe #44 onions grown on muck soil at Clear Lake, Iowa. Pre-emergence treatments consisted of

Stoddard solvent, 100 gals./A; 2,4-D amine, ½ lb./A in 50 gals. water; 2,4-D amine, 1 lb./A in 50 gals.; Na-PCP, 4 lbs./A in 50 gals.; Dow General, 1½ pts./A in 50 gals.; and 2,4-D Na salt, 1 lb./A in 50 gals. Post-emergence treatments consisted of potassium cyanate (1% and 2% in successive applications) and sulphuric acid(2%). Both materials were sprayed at the rate of 100 gals./A. A treatment consisting of deep cultivation during mid-summer was also compared to the hand-weeded check. All pre-emergence sprays except Stoddard solvent gave effective weed control, however, Na-PCP and Dow General gave a very marked reduction in stand of onions as well as a highly significant decrease in yield. Although the 1 lb. of 2,4-D amine gave slightly better weed control than the ½ lb. treatment, the yield was significantly reduced from the check. This indicates the desirability for determining a proper balance between effective weed control and reduced stand and/or yield. The post-emergence sprays both gave significant reductions in yield, KOCN at the 5% level and H_2SO_4 at the 1% level. Both post-emergence sprays greatly reduced the weed population but also resulted in tip burn of the small onion plants. The deep cultivation treatment gave only a slight reduction in yield during the cool summer of 1950. (Department of Horticulture and Department of Botany and Plant Pathology, Iowa Agr. Exp. Sta., Ames, Iowa.)

Maleic hydrazide on potatoes. Denisen, E. L. Kennebec potatoes were sprayed with five concentrations of M. H. on three dates to determine the vine killing possibilities and the effect on yield and storage quality. Concentrations of 375, 750, 1500, 3000 and 6000 ppm. were applied on July 6, July 20 and July 28, 1950. Earlier maturity of the vines resulted with the 750 ppm. and higher concentrations at all dates of application. The two highest concentrations of the first application stunted the plants very severely and resulted in the formation of numerous aerial tubers at the nodes. Yields of the first date of application showed a marked reduction with increasing concentration. The reduction in yield on the second date of application was considerably less than the first and the third date of application showed no significant reduction in yield at any of the concentrations used. In addition to aerial tubers, the plants sprayed with 3000 and 6000 ppm. on the first date produced numerous tubers that were misshaped and very small in size. Specific gravities of the tubers produced showed no significant differences between treatments or dates of application. The tubers were placed in storage to determine their keeping qualities as a result of the spray treatments. (Horticulture Department, Iowa Agr. Exp. Sta., Ames, Iowa.)

Maleic hydrazide on sweet corn. Denisen, E. L. and Haber, E. S. Maleic hydrazide was sprayed at three concentrations and two dates on the female parent in a sweet corn crossing block in an attempt to promote sterility of anthers. Iowa inbreds 453 and 5125 were used as the male and female parents respectively. M. H. was applied at 250, 500 and 1000 ppm. of the active ingredient (diethanolamine salt) at the rate of approximately 60 gals. per acre. The first date of application was on June 30 when the growing points of the female plants were from 2 to 4 inches above the first node and the second date July 12 when the growing point was 8 to 12 inches above the first node. The plots sprayed at the first date showed a marked reaction to the M. H. treatment. Tassel development was suppressed at each spray concentration, however, 250 ppm. was not sufficient to prevent pollen shedding and 500 ppm. greatly dwarfed the tassel which had empty glumes except for a few at the basal part of the tassel which shed viable pollen later. The 1000 ppm. application seriously dwarfed the corn in addition to causing a weakly developed sterile tassel. The second date of application was too late for effective control of tassels, however, the yields were reduced with the increases in concentration. The yields of all treated

plots were below those of the hand-detasseled check. Germination tests on the seed produced on treated plants are being made. (Horticulture Department, Iowa Agr. Exp. Sta., Ames, Iowa.)

Effect of varsol applied as pre- and post-emergence treatments on vegetables. Friesen, H. A. and Howat, M. G. Varsol at the rates of 60, 80 and 100 gals. per acre was applied as a pre-emergence treatment 3 days prior to the emergence of beets, spinach, parsnips, turnips, carrots and onions. Growing conditions were excellent. A very light rain fell between the time of treatment and emergence. Due to the late date of planting (June 30), the weed population was small, and it consisted of such weeds as red root pigweed, groundsel and prostrate pigweed. Varsol as a post-emergence treatment at 3 rates, viz: 30, 50 and 80 gals. per acre, was applied almost 4 weeks after emergence of parsnips, carrots and the transplanting of celery. Varsol as a pre-emergence spray at 60 gals. per acre had no effect on either the vegetables or the weeds. At the 80 gals. rate, 85 per cent of the carrots had their upper leaves reduced in width by about 60 per cent of normal. The 100 gals. per acre rate killed all carrot seedlings, but it had no apparent effect on the other vegetables. The 80 gals. rate delayed weed emergence by 2 weeks; moreover, the 100 gals. rate killed some 90 per cent of the weeds. Post-emergence treatments at each rate of varsol applied, killed the parsnips and carrots. The 30 gals. rate caused severe stunting and twisting of the celery (unmarketable), and the 100 gals. rate slowly killed all celery plants. Nearly complete kills of red root pigweed, groundsel and prostrate pigweed resulted from each treatment. (Dominion Experimental Station, Scott, Sask.)

Effect of 2,4-D on vegetables. Friesen, H. A. and Howat, M. G. The ester of 2,4-D was applied at 4 rates, viz: ¼, ½, 1 and 1½ lbs. of acid equivalent per acre, 3 days prior to the emergence of peas, corn, snap beans and cucumbers. The amine of 2,4-D was used as a post-emergence treatment. Peas were treated with 1/3, 2/3 and 1 lb.; corn and potatoes with 2/3, 1, 1 1/3 and 1 2/3 lbs. and snap beans were treated with 1/3, 2/3, 1, 1 1/3 and 1 2/3 lbs. of acid equivalent per acre. The vegetables were planted on June 30, and the treatments were made 4 weeks after emergence. Growing conditions were excellent. The effect of the pre-emergence treatments on peas was complicated by root-rot; however, a reduction in the stand was noted as a result of the 1½ lb. treatment. Cucumbers emerged, but the seedlings were killed by each treatment. The ¼ and ½ lb. rates caused slight leaf deformities in beans; the 1 and 1½ lb. treatments caused twisted stems and deformed leaves. Corn was not affected by any of the treatments. The post-emergence treatments on peas greatly reduced growth and resulted in major plant deformities. The 1 lb. rate resulted in a high proportion of sterile pods. Some recovery was noted one month after treatment. Lodging in corn, chiefly due to the stunted brace roots and brittle stems, was noted as a result of each treatment; this increased in severity as the dosage was increased. Vigor was impaired. For example, the 1 2/3 rate reduced the plant weight by 50 per cent. Potato vines, 8 inches tall, were lodged and growth was retarded for some 10 days by each treatment. All treatments caused severe stem curling and prevented flowering in beans. (Dominion Experimental Station, Scott, Sask.)

Effect of maleic hydrazide on vegetables. Friesen, H. A. and Howat, M. G. The diethanolamine salt of maleic hydrazide was sprayed as a water solution at 2 concentrations, viz: .25 and .50 per cent, on beets, chard, spinach, cucumbers, onions, peas, potatoes and tomatoes. The vegetables, except potatoes and tomatoes, were planted on June 30, and the treatments were made on August 5. Each concentration was applied in sufficient quantity to wet the foliage. A wetting agent, 1 cup of Dreft per 2 gals. of water, was used. Moisture and temperature

factors were conducive to rapid growth. At each concentration there was no apparent effect on peas or onions. Beets and chard showed a marked reduction in vigor and a loss of 50 per cent in yield at the .5 concentration. At the .25 concentration there was a temporary retardation of growth and a slight reduction in yield. Both concentrations resulted in temporary wilting and twisting of the spinach plants. There was a very slight reduction in the yield of spinach as a result of the heaviest treatment. Cucumbers were severely wilted and growth was arrested for a period of 5 days, after which time apparently normal growth was resumed. The treated and untreated plants were killed by frost on August 18. The potatoes, which had emerged 2 weeks prior to the time of treatment, were inhibited to the extent that the treated plants were almost 30 per cent shorter than the untreated plants. Growth of the treated plants had just been resumed when the vines were killed by frost. Essentially similar effects from the use of this chemical were observed when it was applied to tomatoes one month after transplanting. (Dominion Experimental Station, Scott, Sask.)

Effects of pre-emergence applications of herbicides on potatoes. Grigsby, B. H. Three varieties of potatoes in randomized replicated plots were planted on muck soil. The varieties used were Chippewa, Sebago and Red Warba. Chemicals used and rates of application were as follows: 2,4-D, amine, 2 lbs. per acre; dinitro (Premerge) 4 lbs., PCP; Na salt, 12 lbs.; ME 3003, 5 lbs.; $PECX_3$, 5 lbs.; EH No. 1, 2 lbs.; EH No. 2, 5 lbs.; Xanthogen disulfide, 5 lbs.; and TCA, 10 lbs. Emergence of potatoes was not receded by any treatment. 2,4-D plots all showed leaf modification until the potatoes were 8-12 inches in height but later growth did not show this effect. Satisfactory weed control was obtained with dinitro, PCP, PEC and Xanthogen disulfide. All other materials gave poor control of purslane and annual grasses. Yield of potatoes in all cases were equal to or greater than the untreated plots. (Michigan Agricultural Experiment Station.)

Post cutting weed control in asparagus. Grigsby, B. H. Applications of dinitro; PCP, Na salt; and dusting grade cyanamide were made to asparagus after discing at the end of the cutting season. The chief weeds in this field were lamb's quarter's, red-root pigweed and annual grasses. Dinitro at 4 lbs. per acre and PCP at 8 lbs. gave control of the broad-leaved weeds but did not kill the grasses. New seedlings of all types appeared within 10 days. Severe bending and malformation of asparagus developed within 48 hours after spraying. Dusting cyanamide, 75 lbs. per acre, applied as a spray gave perfect control of both grasses and broad-leaved weeds and did not cause any injury to the asparagus. A wetting agent was used in the spray suspension. (Michigan Agricultural Experiment Station.)

Pre-emergence use of herbicides on onions. Grigsby, B. H. Pre-emergence sprays of 2,4-D, amine, at 1 and 2 lbs.; dinitro at 1 and 2 lbs.; cyanate at 12 and 16 lbs.; PCP (in oil) at 8 and 12 lbs.; aromatic oil at 40 and 60 gals.; TCA at 8 and 12 lbs.; Xanthogen disulfide at 10 and 20 lbs.; EH No. 1 at 2 and 3 lbs.; EH No. 2 at 5 and 10 lbs.; and PCP, Na salt, at 8 and 16 lbs. were applied to onions 6 days after seeding. Weed control ranged from 0 to 50% for all species of weeds. TCA gave 80% reduction in grasses but had no effect on broad-leaved species. Greatest total reduction of weeds was caused by EH No. 1 and PCP, Na salt. Onion stands were reduced by all treatments but greatest effects were caused by the dinitro and PCP sprays. Least reduction was caused by cyanate, 2,4-D and EH No. 1. Yields were reduced by all treatments which caused more than 10% stand reduction. (Michigan Agricultural Experiment Station.)

The response of red beets to pre- and post-emergence applications of herbicides. Holm, L. G. and Tibbitts, T. W. Angrow canner beets were planted in a four replication randomized test on May 19 on a silt loam soil for the purpose of studying the response to pre- and post-emergence applications of herbicides. The initial application of the chemicals was made at the time when about 1 percent of the beets (based on ultimate stand) were beginning to emerge. Stand counts were taken on July 1 and the beets were harvested on August 30. The pre-emergence treatments, applied on May 27, and the post-emergence treatments (underlined), applied on June 18 were as follows (all concentrations are in pounds per acre of acid equivalent or active ingredient of the appropriate compounds): ME 3003 (disodium 3,6 endoxohexahydropthalate) at 2 and 2 lbs., ME 3003 at 4 and 4 lbs.; 5722 (in oil) at 2 and 2 lbs., 5722 at 4 and 4 lbs. TCA (sodium salt) at 12 and 4 lbs., TCA at 20 and 8 lbs.; Stoddard Solvent at 50 and 50 gals., Stoddard Solvent at 80 and 80 gals.; and potassium cyanate at 5 and 5 lbs. The latter treatment also included a 10 lb. post-emergence application on July 1. The 2 and 2 lbs. and the 4 and 4 lbs. rates of ME 3003 gave significant reductions in yield of beets. This reduction was equivalent to 26 percent and 33 percent respectively. The stand of beets was not reduced significantly. 5722 and TCA showed no reductions in stand or yield at any of the concentrations used in this experiment. All applications of potassium cyanate and Stoddard Solvent caused highly significant reductions in yield. (Dept. of Horticulture, University of Wisconsin, Agr. Exp. Sta., Madison, Wis.)

Pre-emergence chemical weed control in red beets. Holm, L. G. and Tibbits, T. W. Beets (Asgrow Canner) were planted in a four replication randomized test on May 19 on a Miami silt loam soil. The chemical treatments described below were applied on May 26 prior to emergence of the beets. At this date large numbers of seedlings of annual broadleaved weeds and grasses had emerged in the area. No precipitation occurred in the 72 hours following treatment. On June 21 stand counts of beets and weeds were made and subsequently 1/2 of each plot was kept free from weeds. The chemical treatments were as follows (all concentrations are in lbs. per acre of acid equivalent or active ingredient of the appropriate compound): Shell 130 (PCP in oil) 5 and 10 gals. diluted to 40 gals. per acre; ME 3003 (disodium 3,6 endoxohexahydrophthalate) at 2,4 and 8 lbs.; E.H. No. 2 (dichloral urea) 2 1/2, 5, and 10 lbs. per acre; 5722 (in oil) 1, 2 and 4 lbs.; IPC (emulsifiable oil) 5, 10, and 20 lbs. and Premerge (DNOSBP) 5, 10, 20 lbs. Premerge, Shell 130, 5722 and E.H. No. 2 in all concentrations either drastically reduced the yield of beets or failed to give effective weed control. Weed control provided by ME 3003 did not vary markedly with the concentrations used. In general weed stands were 50 per cent of those in the check plots. The stand of beets was reduced but not to a significant degree. Five and 10 lbs. of IPC caused no significant reduction in the stand of beets but failed to provide effective weed control. Twenty lbs. of IPC provided a significant reduction in the stand of grasses with no reduction in broadleaved weeds. The stand of beets was significantly reduced, however. Yield data on beets was not significant due to the competition of the weeds remaining in the check plots and those in which weed control was poor. Similar results were obtained from an identical experiment which was conducted concurrently on a muck soil less than 1/2 of a mile away. (Dept. of Horticulture, University of Wisconsin, Agr. Exp. Sta., Madison, Wis.)

The response of carrots to pre-emergence treatments with TCA. Holm, L. G. Red-cored Chantenzy carrots were planted on a Miami silt loam soil on June 29 and were sprayed with 12, 16 and 20 lbs. (acid equivalent) per acre of the sodium salt of TCA on July 5. Emergence of the seedlings took place on July 8 and 9. A three replication randomized design was used for the experiment. On the seventh day after the TCA was applied 0.8" of rain fell and within 14 days after the treatments,

9.14" of precipitation had occurred. The plots were maintained free from weeds at all times. The yield of the treated plots was equal to or exceeded the yield of the control plots. No injury was apparent on the foliage nor was excessive deformation of roots apparent at harvest on October 3. The possibility that the enormous quantity of precipitation which fell in a relatively short period may have removed the chemical from the zone of development of the roots bears further consideration. However, an identical experiment on onions located immediately adjacent to, and running concurrently with this test showed very severe symptoms of typical TCA monocot injury. (Dept. of Horticulture, University of Wisconsin, Agr. Exp. Sta., Madison, Wis.)

The response of red beets to irrigation at various intervals after pre-emergence treatment with TCA. Holm, L. G. Two experiments were conducted on a Miami silt loam soil to study the response of beets (Asgrow Canner) to precipitation after pre-emergence applications of TCA (sodium salt). The experiments, which were initiated on July 10 and 28 were allowed to run for approximately 80 days. Each plot consisted of two 12 foot rows with a guard on either side. TCA concentrations of 8 and 15 lbs. of acid equivalent per acre were used. The chemical was applied in appropriate concentration to all plots 72 hours after planting at which time one plot received 1/2 acre inch of water from an overhead irrigation system. Another plot received the same quantity of water 24 hours prior to emergence of the beet seedlings, another was irrigated during emergence, and the last application of water was 24 hours after emergence. No injury to tops or roots was apparent as a result of the treatments and the stands and yields on all irrigated plots were approximately the same as on the controls which had been sprayed with TCA but had received no water. The yield data showed remarkable agreement between the two experiments. (Dept. of Horticulture, University of Wisconsin, Agr. Exp. Sta., Madison, Wis.)

The effect of pre-emergence herbicides on weed control, stands and yields of spinach. Holm, L. G. Nobel spinach was planted in a four replication randomized test on May 16 in a dry Miami silt loam. On May 22, PCP (sodium salt) at 5 and 15 lbs. of active ingredient per acre, TCA (sodium salt) at 5, 10 and 20 lbs. of acid equivalent, Sulfasan (ethyl xanthogen disulfide) at 15 and 25 lbs. of active ingredient, and E.H. No. 1 (sodium 2,4-dichlorophenoxyethyl sulfate) at 2 and 4 lbs. of active ingredient were applied in 40 gals. of water per acre. Rainfall totaled 1.95 inches during the 72 hours after the treatment. A limited number of annual broad leaved and grass weeds had appeared at the time the materials were applied and approximately 5 per cent (based on ultimate stand) of spinach seedlings were just emerging through the soil. After the weed and stand counts were taken, with the exception of the control, the plots were hand-weeded for the remainder of the growing season. PCP 5 lbs., TCA 20 lbs., Sulfasan 25 lbs., and E.H. No. 1 at 2 lbs. reduced the stands of weeds to 35, 64, 38, and 14 per cent, respectively, of the unweeded control. The stands of spinach were thinned by the treatments and the yields, though not reduced significantly, were decreased to some extent. TCA at 10 lbs. per acre caused some decrease in yield of spinach, though not to a significant degree. The stand of spinach was not affected by this treatment, and the number of weeds was reduced by 50 per cent. An identical experiment was conducted concurrently on muck soil less than 1/2 of a mile away. The weeds in this area were predominantly the annual broad leaved type. PCP 5 lbs., TCA 20 lbs., and Sulfasan 25 lbs. gave excellent weed control but reduced the stands of spinach significantly. On the muck E.H. No. 1 at 2 lbs. per acre did not reduce the stand of spinach significantly but failed to provide the effective weed control it had exhibited on the upland soil. TCA at 10 lbs. per acre again reduced the number of weeds by 50 per cent and permitted a stand of spinach equal

to that of the hand-weeded plots. Yield figures were not obtained because the crop was destroyed by flood. (Dept. of Horticulture, University of Wisconsin, Agr. Exp. Sta., Madison, Wis.)

Sweet corn pre- and post-emergence spray studies. Lana, E. P. and Staniforth, D. W. Pre-emergence sprays on Iochief using 2,4-D amine at the rate of 2 lbs. acid equivalent per acre applied within 24 hours after planting did not reduce plant stand, when compared with the untreated control. Excellent weed control was obtained even though a 2½ inch rain fell three hours after herbicidal application and a subsequent growing season which averaged 8° below normal. The pre-emergence plots were divided into two groups at cultivation time; one group had the first cultivation eliminated while the second group had the first and second cultivations eliminated. There were no significant increases in yields of the pre-emergence plots over the greatest yields. Plots receiving single post-emergence sprays of ½ lb. amine or ¼ lb. ester on June 16 and another set of plots receiving a similar treatment on July 1 showed no significant differences in yields when compared with the untreated plots. Plots receiving two applications of ¼ lb. ester on June 16 and July 15 showed no significant differences in yield. Lay-by sprays of Experimental Herbicide 1 and 4 lbs. per acre and 2,4-D ester at 2 lbs. per acre on plots receiving the three cultivations showed an increase in yield that was not significant. Drop nozzles were used when this spray was applied to eliminate contact, as much as possible, with the plant. The data suggest that the rates of the pre-emergence, post-emergence and lay-by sprays utilized were not detrimental to yields. (Iowa Agr. Exp. Sta., Ames, Iowa.)

Sweet corn inbred hybrid spray study. Lana, E. P. Inbred 1P39 has been shown to be susceptible to applications of 2,4-D while inbred 45 is comparatively resistant. The purpose was to determine the inherent aspects as determined by the hybrid Ioana. Three dates of application were used: June 16, July 1 and July 15. Planting date was May 20. The treatments beside the control were ½ lb. and 1 lb. acid equivalent of 2,4-D amine. Individually each line showed no significant difference in yield between dates. 1P39 was the only line to show a significant difference in the treatment in that the untreated produced a larger yield than either treatment with the 1 lb. rate giving the least yield. The composite split-split plot analysis showed no significant differences for dates. The untreated was highly significant over the ½ lb. and the 1 lb. rates. Observations on plant growth reaction were made on July 6 and August 8. 1P39 showed the greatest amount of abnormalities as indicated by stalk curvature and "onion leaf" formation. The June 16 treatments were more severe in their reaction than the later treatments. The heavier dosage was more severe than the lighter application. These abnormalities tended to normality as the season progressed. Inbred 45 exhibited no abnormalities except for a very slight bending after the July 1 treatment. This entirely disappeared by August 8. Ioana gave very slight onion leaf reaction from the June 16 spray of ½ lb. amine. This disappeared by August 8. The 1 lb. treatment gave a moderate reaction which resulted in a slight stunting effect on August 8. The sprays applied on July 15 showed no abnormalities on August 8. (Iowa Agr. Exp. Sta., Ames, Iowa.)

Lima and snap bean pre-emergence study. Lana, E. P. Three pre-emergence treatments were applied within 24 hours of planting; Na salt PCP 15 lb., Dow Premerge 1 lb. and 2,4-D amine 1 lb. acid equivalent per acre. A post-emergence spray of E.H. No. 1 at 1 lb. per acre was applied after the control was cultivated to test the reaction of this herbicide on plant growth and yield. There were no significant differences in plant stand for the pre-emergence treatments when compared with the untreated for both lima and snap beans. On the lima beans the days

to cultivation were significantly higher for the amine treatment with no significant differences found for PCP and Premerge. The days to cultivation for the snap beans were highly significant for all three pre-emergence treatments. There were no significant differences in yield on the pre-emergence treatments for both types of beans. E.H. No. 1 as a post-emergence spray caused some leaf curvature and delay in blossoming, but the reduction in yield compared with the control was not significant for either lima or snap beans. (Iowa Agr. Exp. Sta., Ames, Iowa.)

Pre-emergence sprays on direct-seeded tomatoes. Lana, E. P. The materials used and rates per acre applied 5 days before general emergence were: Stanisol, 80 gals.; Na salt PCP 10, 5 and 2½ lbs.; Na salt of 2,4-D, 1 lb. acid equivalent; 2,4-D amine, 1 lb. acid equivalent; non volatile ester of 2,4-D, 1 lb. acid equivalent; Dow General, 3 pts. and 24 pts. oil per 100 gals. water; E.H. No. 1, 1 lb.; Dow Premerge, 2 lbs.; 90 per cent TCA, 5 lbs.; Dow Selective, 2 gals.; and Acetanalide, 1 lb. in No. 2 fuel oil per 100 gals. water. Weed control was spotty due in part to the excessive moisture following the herbicidal applications. The mean temperature for the season following spray applications was about 8° below normal. There was a significant difference in weed stand based on the number of days to cultivation over the control in the plots treated with 10 lbs. PCP, Na salt 2,4-D, Premerge and TCA. The difference between the control and 2,4-D amine, the non volatile ester and Acetanalide was highly significant. TCA and Premerge are apparently leached under high moisture conditions after treatment since plots that were partially water covered gave weed control no better than the untreated plots. Stand was significantly less at the one per cent level three weeks after general emergence for all treatments except Stanisol, TCA, Na PCP 2½ lbs., Na PCP 5 lbs. and Dow Selective. Premerge practically eliminated the tomato plants while Na PCP 10 lbs. cut stands 75 per cent. Stunting was observed on plants of the plots that received Na PCP 10 lbs., Na salt 2,4-D, 2,4-D amine, non volatile ester, Premerge and Acetanalide. No yields were taken because of the lateness in fruit ripening. (Iowa Agr. Exp. Sta., Ames, Iowa.)

Tolerance of tomatoes to Maleic Hydrazide. Lana, E. P. Preliminary greenhouse studies indicated that growth of tomato plants could be retarded by the use of various concentrations of Maleic Hydrazide. Inhibition was increased with increase in concentration. 2,000 ppm was not fatal but main stem and lateral growth was almost completely inhibited. Field studies with applications of 250, 500, 1,000 and 2,000 ppm gave similar results. However, recovery at 2,000 ppm was more evident. The effect of pruning by removing the main stem appeared more effective in stimulating lateral growth than M. H. applications. There was a highly significant increase in length of the main stem of the untreated over the four applications, with the least growth on the heaviest application. One month after application there were no significant differences between the control and the pruned plants in total vine length. The M. H. plants showed a highly significant growth retardation. Number of laterals produced on 250 and 500 ppm plants showed no decrease while the number on the 1,000 ppm and pruned were highly significantly less. The 2,000 ppm had no laterals at this time. Yields taken up to frost showed a highly significant decrease in yields between the control and M. H. treatments with the decrease varying directly with the increase in strength. No ripe fruits were produced at 2,000 ppm. There was no significant difference in yield between the control and pruned treatment. Pruning delayed harvesting two weeks but the amount of fruit harvested on the first pruned picking equaled the yield of the first three harvests of the control. Harvests were delayed three weeks by 250, 500 and 1,000 ppm. (Iowa Agr. Exp. Sta., Ames, Iowa.)

A study on the post-emergence application of herbicides to onions. Nylund, R. E. Brigham Yellow Globe onions, seeded on muck soil on May 15, were sprayed with the following herbicides on June 14 when the onion plants were in the one-leaf stage: potassium cyanate at 8, 12, and 16 lbs. per acre, Stoddard solvent at 80 gals. per acre, Xanthogen disulphide at 10 and 20 lbs. per acre, sodium trichlorophenate and sodium tetrachlorophenate at 15 and 20 lbs. per acre, and E.H. No. 5722 at 1 and 2 lbs. per acre. Most of these herbicides were applied both over the row (unshielded) and along both sides of the row protecting the tops of the onion plants by using a shield on the sprayer (shielded). The only treatment which significantly reduced weed population without reducing yields of onions when applied over the top of the row was potassium cyanate at 8 lbs. per acre which killed 56 per cent of the weeds present. Six of the "shielded" treatments gave significant weed control without reducing yields: potassium cyanate at 12 lbs. and at 16 lbs., Xanthogen disulphide at 10 lbs., sodium trichlorophenate at 20 lbs., and sodium tetrachlorophenate at 15 and 20 lbs. Percentages of weeds killed by these six treatments were 62, 77, 55, 78, 51, and 66, respectively. Principal weed species present were (in descending order of number present): Capsella bursa-pastoris, Amaranthus retroflexus, Polygonum persicaria, Setaria glauca, Portulaca oleracea, and Chenopodium album. (Paper No. 724 of the Misc. Journal Series of the Minnesota Agr. Exp. Sta., St. Paul, Minn.)

A study on the toxicity of potassium cyanate to onions as influenced by date of planting, stage of growth, and rate of application. Nylund, R. E. Brigham Yellow Globe onions were seeded on muck soil on May 25, June 5, and June 15. Potassium cyanate at rates of 8, 12, and 16 lbs. per acre (in 80 gals. water) was applied to plots in each of these seedings when onions had reached the crook stage, late first-leaf stage and early third-leaf stage. Sprays were applied at 50-60 lbs. pressure directly over the onion row using a knapsack sprayer fitted with a flat-fan nozzle. All plots were hand-weeded to eliminate weed competition. Observational notes on growth as well as stand counts and yield data showed that potassium cyanate at the rates used had no toxic effect on the onion plants irregardless of the stage of growth at the time of application. These results differ from results obtained in a previous year when 16 lbs. of potassium cyanate caused serious damage to onions. The fact that all through the period of spraying in 1950 (June 7 - July 29) temperatures and precipitation were below normal may explain the differences in results obtained. In the previous year the temperature was somewhat higher and the soil moisture content was considerably higher which would tend to make the plants more succulent and thus more susceptible to chemical action. (Paper No. 713 of the Misc. Journal Series of the Minnesota Agr. Exp. Sta., St. Paul, Minn.)

A study on the effects of 2,4-D and MCP on yields and tuber color of Pontiac potatoes. Nylund, R. E. Pontiac potatoes planted on May 15 on muck soil were sprayed with 2,4-D (alkanolamine salt) and MCP (amine salt) at $\frac{1}{4}$, $\frac{1}{2}$, and 1 lb. per acre at four stages of growth: (1) when plants were 6-8" tall (June 12), (2) when plants were 12-18" tall (June 26), (3) when plants were in bud stage (July 10), and (4) at end of flowering period (Aug. 21). All sprays were applied with a knapsack sprayer at approximately 50 lbs. pressure and 40 gals. water per acre. All 2,4-D and MCP treatments tended to reduce yields of U. S. No. 1 tubers with the 2,4-D treatments causing the greatest reductions. 2,4-D at $\frac{1}{2}$ or 1 lb. per acre when applied to plants 6-8" tall, all three 2,4-D treatments when applied to plants 12-18" tall or in the early bud stage, and 1 lb. of 2,4-D when applied to plants at the end of the blossoming period significantly reduced yields. Only one of the MCP treatments ($\frac{1}{2}$ lb. applied to plants 12-18" tall) significantly reduced yields; however, all of the other MCP treatments tended to reduce yields. Field notes on tuber color taken at time of harvest

indicate that, in a general way, those treatments that most seriously reduced yields caused the greatest intensification of red periderm color. 2,4-D at ½ and 1 lb. when applied to plants 12-18" tall and 2,4-D at all rates when applied to plants in the bud stage significantly intensified tuber periderm color. Also, MCP applied at ¼ and 1 lb. to plants in the bud stage significantly intensified periderm color. Laboratory studies on the effects of the 2,4-D and MCP treatments on dry matter content, on Vitamin C content, and on anthocyanin content are being conducted. (Paper No. 726 of the Misc. Journal Series of the Minnesota Agr. Exp. Sta., St. Paul, Minn.)

A study on the chemical control of weeds in onions by pre-emergence treatments. Nylund, R. E. On May 18 muck soil which had been prepared on May 11 was seeded to Brigham Yellow Globe onions. On the seventh day after seeding the following twenty pre-emergence treatments were applied to plots replicated five times: potassium cyanate at 12, 16, and 20 lbs. per acre; Esso No. 45, Stoddard solvent, and Amsco D oils at 40 and 80 gals. per acre; Xanthogen disulphide at 10 and 20 lbs.; sodium isopropyl xanthate at 15 lbs.; sodium trichlorophenate at 10 and 15 lbs.; sodium tetrachlorophenate and sodium o-phenylphenate at 7.5 and 10 lbs.; and E.H. No. 1 (sodium 2,4 dichlorophenylphenate) at 2 and 4 lbs. Air temperature at the time of spraying was 60° F., humidity 58 per cent, and the soil was moist. All of the treatments with the exception of E.H. No. 1 significantly reduced weed populations. However, Xanthogen disulphide at 10 and 20 lbs., sodium isopropyl xanthate, sodium tetrachlorophenate at 10 lbs., and sodium o-phenylphenate at 7.5 lbs. significantly reduced stands and yields of onions. Treatments which gave 90 to 100 per cent weed control without reducing onion stand and yields were: potassium cyanate, Esso No. 45, and Amsco D at all rates used; and sodium trichlorophenate at 15 lbs. per acre. Other treatments gave weed control ranging from 64 to 86 per cent. (Paper No. 714 of the Misc. Journal Series of the Minnesota Agr. Exp. Sta., St. Paul, Minn.)

Summer weed control in onions with non-selective herbicides and a covered-boom sprayer. Peterson, Clinton E. and Denisen, E. L. A 4-row sprayer designed and constructed by Lloyd Lamouria of the Agricultural Engineering Department to protect onion foliage and confine sprays to the area between rows was used in application of four herbicides. Treatments applied on August 8 included 2 per cent Sodium PCP in water, 2 per cent PCP in oil, 5 per cent potassium cyanate plus wetting agent, and DNOSBP (Dow General). In order to determine the effect of mechanical injury to the onions, the sprayer was run through one set of check plots cultivated in the usual manner and another set of cultivated plots was unmolested. There was no significant difference in yields from the 6 treatments. Purslane and grasses treated with the chemicals were effectively controlled. This means of application should provide an effective control for weeds during the period when mechanical cultivation causes root damage to the crop and aerates the soil thus allowing re-infestation from dormant seeds. Furthermore, the spray treatments were more effective in killing purslane than is usually the case with mechanical cultivation. (U.S.D.A. Bur. Plant Industry Soils and Agr. Engineering and Iowa Agr. Exp. Sta., Ames, Iowa.)

Post-emergence chemical control of weeds in onions (greenhouse preliminaries). Taylor, Clifford E. Plots down greenhouse benches containing Southport Yellow Globe seedlings and Golden Globe onions from sets were treated 44 days after planting. Treatment day was partly cloudy with a temperature of 68-74° F. Plots were watered by overhead sprinkling two days before and one day after treatments. The majority of the seedlings were in the 3rd-true-leaf stage. Diesel oil at 100 gals. per acre: 77% weed control but severe burn to all onions.

Sulfuric acid at 2½% in 100 gals. water per acre: 52% weed control and slight tip burn to the onions. Na-PCP at 1, 2½ and 4 lbs: 47, 67 and 83% weed control, none, slight and moderate burn to onions from sets, very slight to moderate tip burn on onions from seed. PCP at 1% in 100 gals. diesel oil per acre: 100 % weed control and complete kill of onions. Sinox at 3 pints: 23% weed control, no injury to onions from sets, very slight tip burn to onions from seed. Dow Selective at 3 pints, alone and with a spreader-sticker: 5% and 75% weed control, slight tip burn to onions. Na-2,4-D at ¼, ½ and 1 lb. and at ¼ and ½ lb. with a spreader-sticker: 7% - 43% weed control, slight to severe curling of the onion leaves. Stoddard solvent at 40 and 80 gals. per acre: 63 and 95% weed control, moderate to severe burning of onions. KOCN at 1% and 2%: 50 and 60% weed control, no injury to onions at 1% and a slight tip burn at 2%. NaCl at 25% in 100 gals. water per acre, alone and with a spreader-sticker: 53 and 73% weed control, and a slight tip burn to the onions. Only Na-PCP at 2½ lbs. per acre, KOCN at 2%, Dow Selective at 3 pints and NaCl at 25%, both with a spreader-sticker and both with water at 100 gals. per acre, were the only treatments appearing encouraging. (Illinois Agricultural Experiment Station, Urbana, Illinois.)

Post-emergence chemical control of weeds in onions. Taylor, Clifford E. Onions from seed (Southport Yellow Globe) and from sets (Golden Globe) were sprayed on June 5 (29-32 days after emergence). The soil surface was moist and the vegetation dry, sunny, temperature 70-78° F. The mean temperature the prior week was 70° F. and the rainfall 0.70". Mean temperature the next week was 66° F., with no rain. Treatments included NH_4-DNOSBP at 3/8 lb. and 25% NaCl, each alone and with a spreader-sticker, Na-PCP at 2½ and 4 lbs., all in 100 gals. of water per acre, and 1% and 2% KOCN in 60 gals. of water per acre. Weeds were mostly pigweeds (Amaranthus spp.) and purslane (Portulaca oleracea). The only weed control was some "spot-burning" of the pigweeds by the two NaCl and the 2% KOCN treatments, with the onions "spot-burned" by Na-PCP at 4 lbs. The same treatments and rates were applied to the same plots on June 11 (6 days later), with soil surface and vegetation being dry, sunny and a temperature of 85-92° F. Mean temperature for the next week was 70° F. with 4.43" rainfall. Results were similar to those above. On June 30 (19 days after the second spraying) the same chemicals were applied to the same plots again, but with an increase in the NH_4-DNOSBP rate to 3/4 lb., KOCN to 3% and 4% and the Na-PCP to 5 and 8 lbs. Mean temperature the prior week was 75° F., with 0.46" rainfall. Mean temperature the next week was 79° F., with 0.83" rainfall. The soil surface and vegetation were dry, and the day sunny with a temperature of 87-95° F. Na-PCP at 8 lbs. stunted the purslane and killed all other weeds and the onions. KOCN at 4% killed all weeds except purslane. All weeds except purslane were severely "burned" by the NH_4-DNOSBP and NaCl treatments, KOCN at 3% and Na-PCP at 5 lbs. The onions were severely "burned" by all but the NaCl treatments. (Illinois Agricultural Experiment Station, Urbana, Illinois.)

Post-emergence chemical control of weeds in onions (Koehler farm). Taylor, Clifford E. Golden Globe onion seed was planted April 20, for sets, on a silty clay-loam soil, with emergence May 12-14. Post-emergence treatments were applied on June 4, 5:00-5:30 P.M., cloudy at the time, and the temperature 66-68° F. The mean temperature for the prior week was 62° F. and the rainfall 5/30 - 0.08", 6/2 - 1.26" and 6/3 - 1.62". Mean temperature for the following week was 72° F. and the rainfall: 6/10 - 0.01". The major weeds present were lambsquarters (Chenopodium album) - small to 3 inches high with 8 leaves, and smartweeds (Rumex spp.) and pigweeds (Amaranthus spp.), small to 2½ inches high

with 6 leaves. The onion seedlings were in the third true-leaf stage. Both the onions and the weeds were considered to be in a very succulent condition. Treatments, each in 100 gals. of water per acre, included NH_4-DNOSBP at 3/8 lb., KOCN at 1% and at 1½% and Na-PCP at 2½ lbs. and at 3½ lbs., plus check plots. There were no effects on the weeds or onions, and the experiment was discontinued. (Illinois Agricultural Experiment Station, Urbana, Illinois.)

Pre-emergence chemical control of weeds in onions (greenhouse preliminaries). Taylor, Clifford E. Plots in the greenhouse containing silt loam soil were planted to Southport Yellow Globe seed and Golden Globe onion sets. Various chemical treatments, each replicated twice, were applied to one series of plots 2 days and a second series 6 days after planting. Stand and weed counts and observations were made after 4 weeks. Treatments included Na-2,4-D at ¼, ½, 1, 2 and 4 lbs. per acre, Stoddard solvent at 80 gals. per acre, 1% and 3% Na-PCP in 100 gals. of water per acre, 1% and 3% PCP in 100 gals. of diesel oil per acre and calcium-cyanamide at 75 lbs. per acre. No injury, or at most very slight, occurred to the onions from sets, from any treatment. With the Na-2,4-D treatments the stand was better and the onion seedling injury less when applied just before emergence than when applied earlier. Percentage of weed control was also higher at the later date. Rates as high as two lbs. per acre seemed satisfactory to use on onions grown from seed. Stoddard solvent was effective in killing weeds which had emerged before application; otherwise it was of little value, having no residual effect on either weeds or onions. The percent of stand of the seeded onions was much reduced and seedling injury rather severe in all treatments using PCP or its salt. Percentage of weed kill was greater when treatments were made just before emergence. Better weed control was obtained with calcium-cyanamide when applied just before emergence rather than earlier. (Illinois Agricultural Experiment Station, Urbana, Ill.)

Pre-emergence chemical control of weeds in onions. Taylor, Clifford E. Southport Yellow Globe seed was planted April 28 on clay loam soil, with treatments applied May 5, emergence May 9-10 and harvest on July 30 as sets. Golden Globe sets were planted April 30, with treatments applied as above (May 5), emergence May 6-8, and harvest on July 28. There were no weeds present at the time of treatments, with the soil surface moderately dry, temperature 85-90° F. For the week prior to treatments the mean temperature was 65° F. and the rainfall: 5/2 - 0.35". For the two weeks following the mean temperature was 57° F. and the rainfall: 5/13 - 0.05", 5/15 - 0.02", 5/16 - 0.13", 5/17 - 0.24", 5/18 - 0.25", 5/19 - 0.31" and 5/20 - 0.89". Weeds present were 88% purslane (Portulaca oleracea), 3% pigweeds (Amaranthus spp.), 6% annual grasses, and 3% miscellaneous. Treatments included xanthogen disulfide at 5 lbs. per acre, Na-2,4-D at ½, 1 and 2 lbs. per acre, Stoddard solvent at 80 gals. per acre and calcium-cyanamide at 75 lbs. per acre. Weed control 8 weeks after treatments with the xanthogen disulfide and Stoddard solvent were zero, and with calcium-cyanamide, 3%. These plots were disked out after weed counts were made. Weed control was highly significant with the Na-2,4-D at ½ lb. (83%), at 1 lb. (91%) and at 2 lbs. (92%). No significant reduction in stand or yield of onions occurred on any of the plots with Na-2,4-D treatment. Percent of loss of Golden Globe bulbs after three months in storage failed to show any ill effects from the Na-2,4-D treatments. (Illinois Agricultural Experiment Station, Urbana, Illinois.)

Time and rate of pre-emergence application of Na-2,4-D to seeded onions for weed control. Taylor, Clifford E. Southport Yellow Globe onions were planted in flats of silt loam soil in the greenhouse and set up as a randomized split plot design. Factors investigated included three times of application: pre-planting (the powder mixed with the soil before planting), pre-emergence as

an aqueous spray immediately after planting and pre-emergence as an aqueous spray just before emergence of the onions, five rates of application: ¼, ½, 1, 2 and 4 lbs. (acid equivalent) Na-2,4-D per acre, and three seed treatments: standard seed, pelleted seed and pelleted seed containing activated carbon, in addition to unsprayed checks. Significant reductions of the stand of onions occurred as follows: 1) Pre-planting Na-2,4-D application, at all rates with the standard seed, at the 2 and 4 lb. rates with pelleted seed and at the ¼, 1, 2 and 4 lb. rates with pelleted seed containing activated carbon, 2) Pre-emergence Na-2,4-D application just after planting, only at the 4 lb. rate with both the standard and pelleted seed, and at 2 and 4 lbs. with pelleted seed containing activated carbon, and 3) Pre-emergence Na-2,4-D application just before emergence, at 2 and 4 lbs. with the standard seed, at 4 lbs. with the pelleted seeds and at 1, 2 and 4 lbs. with the pelleted seed containing activated carbon. Weed control was best when the Na-2,4-D was applied as a spray just before emergence of the onions, and poorest when applied as a spray just after planting. The best balance between weed control and onion stand for herbicidal Na-2,4-D usage in onions was a pre-emergence spray applied just before emergence of the onions at a concentration of 1 lb., using either standard or pelleted seed. (Illinois Agricultural Experiment Station, Urbana, Illinois.)

Pre-emergence chemical control of weeds in onions (sets to bulbs) at three rates of Na-2,4-D (A. Schroeder farm). Taylor, Clifford E. Golden Globe onion sets were planted May 4, on silty clay loam soil, with treatments applied May 10, emergence May 8-15 and harvest August 7. Randomized replicated plots were established to include checks and Na-2,4-D at ½, 1 and 1½ lbs. (acid equivalent) per acre, applied as an aqueous solution in 100 gals. of water per acre in each case. There were no weeds present at the time of treatment. The soil surface was slightly moist with the temperature 55° F. For the week prior to treatments the mean temperature was 57° F. and the rainfall: 5/4 - 1.32", 5/5 - 0.02", 5/6 - 0.17" and 5/9 - 0.23". For the two weeks following the mean temperature was 61° F. and the rainfall: 5/10 - 0.01", 5/22 - 0.04", and 5/23 - 0.03". The major weeds present were pigweeds (Amaranthus spp.) and some annual grasses. Weed control was highly significant at all the Na-2,4-D rates and was approximately the same at each of the three rates (79, 82 and 78%). There were no significant effects on stands, yields or average weight per onion from any treatment. (Illinois Agricultural Experiment Station, Urbana, Illinois.)

Pre-emergence chemical control of weeds in onions (seed to bulbs) at three rates of Na-2,4-D (H. Seegers farm). Taylor, Clifford E. San Joaquin onion seed was planted May 2, on silt loam soil, with treatments applied May 10 and emergence May 12-14. Harvest as bulbs occurred on August 29. No weeds were present at the time of treatments. The soil surface was slightly moist and the temperature 65° F. For the week prior to treatments the mean temperature was 57° F. and the rainfall: 5/4 - 1.32", 5/5 - 0.02", 5/6 - 0.17" and 5/9 - 0.23". For the week following the mean temperature was 61° F. and the rainfall: 5/10 - 0.01". Treatments included checks plus Na-2,4-D at ½, 1 and 1½ lbs., acid equivalent, per acre. Total weed control was 29%, 62% and 53% at the ½, 1 and 1½ lb. Na-2,4-D rates, respectively, but was not significant at any of the rates. The major weeds present were pigweeds (Amaranthus spp.) - 56, 80 and 75% control, smartweeds (Rumex spp.) - 12, 49 and 44% control, and annual grasses - 0, 59 and 23% control. The stand of onions was highly significantly reduced at 1½ lbs. Na-2,4-D per acre. Yields were significantly reduced at 1 lb. Na-2,4-D per acre and highly significantly reduced at 1½ lbs. per acre, with the average weight per onion showing a similar trend. At the 1 and 1½ lb. Na-2,4-D rates the original root system of the onions sloughed off after heavy rains of June 2 and 3, and this injury was further accentuated by heavy irrigation in early July. The

onions replaced their root systems, but the foliage and bulbs were still stunted at harvest time, as compared to the checks. (Illinois Agricultural Experiment Station, Urbana, Illinois.)

Pre-emergence chemical control of weeds in onions (seed to sets) at three rates of Na-2,4-D (Koehler farm). Taylor, Clifford E. Golden Globe onion seed was planted for sets on April 20, on silty clay-loam soil, with treatments applied May 10, emergence May 13-14 and harvest August 15. A few small weeds were present at the time of treatment, with the soil surface moist, sunny, and the temperature 65° F. For the prior week the mean temperature was 58° F. and the rainfall: 5/4 - 0.32", 5/5 - 0.02", 5/6 - 0.17" and 5/9 - 0.23". For the two weeks following the mean temperature was 61° F. and the rainfall: 5/10 - 0.01", 5/22 - 0.04" and 5/23 - 0.03". Treatments included Na-2,4-D at ½, 1 and 1½ lbs. (acid equivalent) per acre, plus checks. Weed control four weeks after treatments was significant at all three Na-2,4-D rates, being 64% at ½ lb., 69% at 1 lb. and 86% at 1½ lbs. per acre. The major weeds present were lamb's quarters (Chenopodium album) - 77, 76 and 92% control, pigweeds (Amaranthus spp.) - 42, 58 and 83% control and smartweeds (Rumex spp.) - 20, 52 and 59% control. There were no significant effects on stand, yield or size of sets from any treatment. Following 2.88" of rainfall on June 2 and 3, the onions on the 1 and 1½ lb. plots showed a partial loss of the initial root system, and a subsequent development of a replacement root system, which tended to be vigorous, stubby and branching. They were temporarily retarded. At the 1 lb. rate the sets essentially caught up with untreated checks prior to harvest. At the 1½ lb. rate a few did not recover, giving the effect of a slightly thinner stand, with the set size averaging slightly larger (but not significantly so). There was no increase in the number of "over-runs". (Illinois Agricultural Experiment Station, Urbana, Illinois.)

Pre-emergence chemical control of weeds in onions (seed to sets) at three rates of Na-2,4-D (W. Sass farm). Taylor, Clifford E. Golden Globe onion seed was planted May 7, for sets, on clay loam soil, with treatments applied May 16, emergence May 19 - 21 and June 13 - 15 (approximately 70% at the earlier date and the remainder after additional rainfall) and harvest August 21. There were no weeds present at the time of treatment, with the soil surface dry, sunny and the temperature 55° F. For the prior week the mean temperature was 61° F. and the rainfall: 5/9 - 0.23" and 5/10 - 0.01". For the three weeks following the mean temperature was 63° F. and the rainfall: 5/22 - 0.04", 5/23 - 0.03", 5/26 - 0.02", 5/30 - 0.08", 6/2 - 1.26" and 6/3 - 1.62". Treatments included Na-2,4-D at ½, 1 and 1½ lbs. (acid equivalent) per acre, plus checks. Total weed control four weeks after treatments was 45% (significant) and 68% and 68% (highly significant) at the ½, 1 and 1½ lb. rates. The major weeds present were pigweeds (Amaranthus spp.) - 67, 71 and 74% control, annual grasses - some control, but not significant, at all three rates, and Creeping Jenny (Convolvulus arvensis) - no significant control. There was no significant reduction in set yield from any of the Na-2,4-D rates. Stands were significantly reduced at all three rates. These stand reductions were essentially restricted to the spots in the row where the onions did not emerge until after the heavy rains of June 2 and 3. Many of the onion seedlings in the 1 and 1½ lb. plots lost and replaced their root systems after the heavy rains of June 2 and 3, and were temporarily retarded. In line with stand reductions the sets were significantly larger on the 1 and 1½ lb. Na-2,4-D plots, but without an increase in "over-runs." (Illinois Agricultural Experiment Station, Urbana, Illinois.)

Pre-emergence chemical control of weeds in red beets. Taylor, Clifford E. Red beets, variety Detroit Dark Red, were planted on April 29, on clay loam soil, in rows 18 inches apart, with treatments applied May 7, emergence May 9-10 and harvest on July 25. There were no weeds present at the time of treatment, with the soil surface dry, cloudy, and the temperature 50-58° F. For the week prior to treatments the mean temperature was 72° F. and the rainfall: 5/2 - 0.35". For the week following the mean temperature was 56° and the rainfall: 5/13 - 0.05", 5/16 - 0.13", 5/17 - 0.24", 5/18 - 0.25", 5/19 - 0.31" and 5/20 - 0.89". The weed population was 87% purslane (Portulaca oleracea) plus some pigweeds (Amaranthus spp.) and annual grasses. Treatments and the percent weed control for each after six weeks: Stoddard solvent at 80 gals. - 10%, Stoddard solvent at 50 gals. fortified with PCP at 15 lbs. per acre - 75%, Na-PCP at 15 lbs. - 73% and at 25 lbs. - 84%, Na-2,4-D at ½ lb. - 91% and xanthogen disulfide at 5 lbs. - 47%. All treatments were per acre, and, except for the Stoddard solvent treatments, were applied in 100 gals. of water per acre. Percent control of the purslane was 13, 82, 73, 85, 92 and 58%, respectively. Total weed control was not significant for the Stoddard solvent used alone, but was highly significant with all other treatments. All treatments which significantly reduced the weed population caused a highly significant loss in both stand and yield of the beets. (Illinois Agricultural Experiment Station, Urbana, Illinois)

Pre-emergence chemical control of weeds in horseradish. Taylor, Clifford E. Horseradish was planted on May 16, on clay loam soil, with treatments applied May 27, emergence June 3-4, and harvest October 27. There were no weeds present at the time of treatments, with the soil surface dry, cloudy, and the temperature 50° F. For the prior week the mean temperature was 54° F. and the rainfall: 5/20 - 0.89", 5/22 - 0.05", 5/24 - 0.02" and 5/26 - 0.01". For the week following the mean temperature was 65° F. and the rainfall: 6/3 - 0.68" and 6/4 - 0.02". The weeds were 86% purslane (Portulaca oleracea) plus some pigweeds (Amaranthus spp.), lamb's quarters (Chenopodium album) and annual grasses. Treatments (all per acre, and in 100 gals. water per acre unless otherwise noted) and the percent weed control for each after six weeks: xanthogen disulfide at 10 lbs. - 51%, NH_4-DNOSBP at 5 lbs. - 73% and at 8 lbs. - 81%, dichloral urea at 2½ lbs. - 16%, Na-PCP at 20 lbs. - 80% and Stoddard solvent at 50 gals. per acre fortified with PCP at 5 lbs. per acre - 70%. Control of purslane was 50, 79, 75, 21, 82 and 67%, respectively. The weed control was not significant with the dichloral urea, significant with the xanthogen disulfide, and highly significant with the other materials. There were no significant stand reductions from any of the above treatments. The dichloral urea and xanthogen disulfide plots were discontinued. Both the total weight of harvested horseradish and the weight of No. 1 roots were significantly lowered by the Stoddard solvent plus PCP treatment. There was no significant effect on yield from any other treatment. No discoloration of any kind occurred on or in the roots as a result of the treatments. (Illinois Agricultural Experiment Station, Urbana, Illinois.)

Pre-emergence chemical control of weeds in peas. Taylor, Clifford E. Three varieties of peas were planted on April 29, on clay loam soil six seeds per foot of row and rows 3 feet apart, with treatments applied May 5, emergence May 9-11 and harvest dates, Alaska and Little Marvel - June 21-29 and Laxton's Progress June 25-July 6. There were no weeds present at the time of treatment, with the soil surface moderately dry, sunny and the temperature 94° F. For the prior week the mean temperature was 65° F. and the rainfall: 5/2 - 0.35". For the next two weeks the mean temperature was 57° F. and the rainfall: 5/13 - 0.05", 5/15 - 0.02", 5/16 - 0.13", 5/17 - 0.24", 5/18 - 0.25", 5/19 - 0.31" and 5/20 - 0.89". Weeds were 95% purslane (Portulaca oleracea) plus some pigweeds (Amaranthus spp.) and some annual grasses. Treatments (all per acre, and in 100

gals. water per acre unless otherwise noted) and the percent weed control for each after 6 weeks: Na-PCP at 20 lbs. - 83%, NH_4-DNOSBP at 5 lbs. - 96% and at 8 lbs. - 98%, Na-DNO-cresylate (Sinox) at 6 gals. - 65%, xanthogen disulfide at 10 lbs. - 0% and Ca-cyanamide at 75 lbs., applied as a powder - 73%. Percent control of purslane was 84, 97, 99, 62, 0 and 79%, respectively. Weed control was not significant with the xanthogen disulfide or Sinox, but was significant with the Na-PCP and Ca-cyanamide and highly significant with the NH_4-DNOSBP treatments. There were no reductions in stand from any treatment. The peas on the Na-PCP plots showed a marked yellowing of the foliage following rainy weather, and later the lower leaves dried up. There was a significant reduction in yield on the Na-PCP plots for the peas Little Marvel and Laxton's Progress, but not for Alaska. The pea yields were not reduced from the other treatments. (Illinois Agricultural Experiment Station, Urbana, Illinois.)

Pre-emergence chemical control of weeds in asparagus. Taylor, Clifford E. Plots were laid out in a nine-year-old asparagus planting, on clay loam and silty clay loam soil. At the end of the normal cutting season the field was disked, with treatments applied on June 30, before emergence had resumed. There were no weeds present at the time of treatment, with the soil surface dry, sunny and the temperature 70-94° F. For the prior week the mean temperature was 75° F. and the rainfall: 6/25 - 0.26", 6/26 - 0.10" and 6/28 - 0.10". For the next two weeks the mean temperature was 76° F. and the rainfall: 7/6 - 0.83", 7/8 - 0.06", 7/9 - 0.10", 7/10 - 0.10" and 7/14 - 1.72". The weeds were 66% pigweeds (Amaranthus spp.), 20% wild lettuce (Lactuca scariola), 11% Canadian thistles (Cirsium arvense) plus others. Treatments (all per acre, and in 100 gals. water per acre unless otherwise noted) and the percent weed control for each after 8 weeks: Na-2,4-D at 1 lb. - 80%, at 2 lbs. - 94%, at 3 lbs. - 97% and at 4 lbs. - 87%, Na-PCP at 15 lbs. - 84% and at 25 lbs. - 84%, NH_4-DNOSBP at 5 lbs. - 51% and at 8 lbs. - 66%, xanthogen disulfide at 5 lbs. - 46% and at 10 lbs. - 79%, Stoddard solvent at 50 gals. per acre plus PCP at 5 lbs. per acre - 67%, and Ca-cyanamide as a dust at 100 lbs. per acre - 33%. The weed control was not significant with the xanthogen disulfide at 5 lbs. and the Ca-cyanamide, significant with the NH_4-DNOSBP at 5 lbs. and highly significant with all other treatments. Control of the pigweeds for the treatments as listed above was 96, 100, 98, 100, 98, 98, 62, 82, 81, 58, 85 and 35%, respectively. There was no stalk curvature or abnormal-appearing spears or foliage on any treatment plot. There were no significant effects on the asparagus stand. (Illinois Agricultural Experiment Station, Urbana, Illinois.)

Post-emergence chemical control of weeds in various Umbelliferae using Stoddard solvent. Taylor, Clifford E. Red-cored Chantenay carrots and Long Smooth Hollow Crown parsnips were planted April 30 and harvested September 29 - 30. Large Smooth Prague celeriac was planted March 3, transplanted April 14, set to field June 9 and harvested October 18. Utah No. 16, Golden Plume and Summer Pascal celery were planted March 14, transplanted April 22-23, set in field June 9-10 and harvested October 18. Treatments included Stoddard solvent at 80, 100 and 120 gals. per acre, plus checks. Post-emergence treatment date was July 5, 10:30-12:30 a.m., partly cloudy, and the temperature 88-93° F. The soil surface and vegetation was dry. There was 0.83" rainfall within the next 24 hours. Weed growth was abundant, ranging from 4" purslane to 8" high pigweeds. The carrots were 15" high with 7-8 leaves, the parsnips 17" with 3-5 leaves, the celeriac 5" with 7-8 leaves and the celery 6-9" with 6-8 leaves. Weed control was 100% at all three rates of Stoddard solvent. At the 80 gal. rate some regrowth of the purslane occurred later. Some foliage burn occurred on the carrots, parsnips and celeriac (but not the celery) at the 120 gal. rate.

The carrot yield was significantly reduced at the two higher rates. The yield of celeriac was highly significantly reduced at all three treatment rates. There were no significant effects on yield for the parsnips or any of the celery varieties. There was no internal discoloration or effects on taste quality at harvest time of any of the Umbelliferae on any treatment. (Illinois Agricultural Experiment Station, Urbana, Illinois.)

Pre-emergence chemical control of weeds in various beans. Taylor, Clifford E. Beans were planted on June 1, on clay loam soil, with pre-emergence treatments applied on June 4, emergence June 8-11. Harvest date for the green snap beans (Tendergreen) and the wax beans (Pencil Pod Black Wax) was August 1-16, for the henderson lima, September 1 and for the Triumph lima (both as dry shell), September 9. There were no weeds present at the time of treatment, with the soil surface moist, sunny and the temperature 70-78° F. The mean temperature for the prior week was 66° F. and the rainfall: 6/3 - 0.70". For the next two weeks the mean temperature was 67° F. and the rainfall: 6/14 - 0.61" and 6/15 - 3.82". Weeds were 99% purslane (Portulaca oleracea). Treatments (all per acre, in 100 gals. water per acre unless otherwise noted) and the percent weed control after 5 weeks for each: Na-2,4-D at ½ lb. - 74%, at 1 lb. - 87% and at 1½ lbs. - 86%, xanthogen disulfide at 10 lbs. - 41%, Na-PCP at 20 lbs. - 75% and NH_4-DNOSBP at 6½ lbs. - 89%. The weed control was highly significant with all treatments. The xanthogen disulfide and Na-2,4-D plots at ½ lb. were discontinued. Significant effects on stands and yields: Henderson lima beans - no effects. Triumph lima beans - stand and yield reduced by Na-PCP, yields reduced by the Na-2,4-D at 1 and 1½ lbs. Wax beans - stand reduced by the Na-2,4-D at 1 lb, yields of both the wax and green snap beans reduced by the Na-PCP and the Na-2,4-D at 1 and 1½ lb. treatments. The Na-2,4-D effects on the beans were not formative, but rather a very marked increase in floral abscission. (Illinois Agricultural Experiment Station, Urbana, Illinois.)

Pre-emergence weeding of snap bean and sweet corn varietal trials with NH_4-DNOSBP. Taylor, Clifford E. Our preliminary investigations on the use of NH_4-DNOSBP as a pre-emergence herbicide in beans and sweet corn were so encouraging that it was decided to use this material on our varietal trials in 1950. The entire trial area was treated, which does not permit any statistical analysis, but a yield comparison of varieties appearing in both the 1949 and 1950 trials would seem appropriate. The 1949 varietal trials were on a clay silt loam soil, and yields were considered excellent. The 1950 trials were on a sandy clay silt loam soil. The sweet corn was planted on June 8 and the snap beans on June 9, with rows 3 feet apart in each case. NH_4-DNOSBP was applied on June 16 (2 - 4 days before emergence) at the rate of 10 lbs. per acre, in 100 gals. of water per acre. The mean temperature for the prior week was 69° F. and the rainfall: 6/9 - 0.74", 6/13 - 1.10" and 6/15 - 0.36". For the following two weeks the mean temperature was 67° F. and the rainfall: 6/16 - 0.79", 6/18 - 1.12", 6/19 0.01", 6/24 - 2.31", 6/28 - 0.07" and 6/30 - 0.03". As determined by adjacent weedy areas weeds were about evenly divided among lamb's quarters (Chenopodium album), pigweeds (Amaranthus spp.), purslane (Portulaca oleracea) and annual grasses, and weed control was 98%. The trials were not cultivated or weeded. The 1949 and 1950 bean yields in tons per acre (the 1949 yield first in each case) were: Topcrop 4.1 and 5.1, Rival 3.4 and 4.4, Black Valentine 2.5 and 3.7, Logan 2.4 and 3.2, Contender 4.4 and 3.0, Tendergreen 2.6 and 2.6 and Fullgreen 3.1 and 2.5. The 1949 and 1950 sweet corn yields in tons per acre were: Golden Security 6.0 and 5.3, Improved Sencross 4.4 and 4.4, Golden Cross Bantam 5.4 and 3.8, Carmelcross 4.5 and 5.6, Ioana 4.7 and 5.2, Calumet 5.1 and 5.2, Illinois 16 - 3.4 and 6.4, Illinois 17 - 4.3 and 6.2 and Illinois 20 - 4.0 and 5.6. (Illinois Agricultural Experiment Station, Urbana, Illinois.)

Pre-emergence weed control in sweet corn. Taylor, Clifford E. Sweet corn varieties Marcross, Our Choice, Golden Cross Bantam, Surecross, Lincoln, Ioana and Golden 60-Day were planted on June 24, on silty clay loam soil, 1½ inches deep. Pre-emergence treatments were applied June 27, with emergence June 29-July 2. There were no weeds present at the time of treatment, with the soil surface moderately dry, and the day sunny with the temperature 74-85° F. For the prior week the mean temperature was 74° F. and the rainfall: 6/21 - 0.03", 6/25 - 0.26" and 6/26 - 0.10". For the next two weeks the mean temperature was 77° F. and the rainfall: 6/28 - 0.10", 7/6 - 0.83", 7/8 - 0.06", 7/9 - 0.10" and 7/10 - 0.10". Weeds were 43% pigweeds (Amaranthus spp.) and 26% purslane (Portulaca oleracea). Treatments (all per acre, and in 100 gals. water per acre) and percent weed control for each after 6 weeks: xanthogen disulfide at 10 lbs. - 0%, Na-2,4-D at 1 lb. - 81%, at 1½ lbs. - 80% and at 2 lbs. - 91%, Na-PCP at 20 lbs. - 66% and NH_4-DNOSBP at 6½ lbs. - 59%. The weed control was significant with all treatments except the xanthogen disulfide. Control of purslane was 0, 60, 92, 96, 0 and 84% respectively. Control of pigweeds was 33, 89, 84, 93, 100 and 77% respectively. There were no ill effects or significant reductions in yield (by number or weight of ears) from any pre-emergence treatment on any variety of sweet corn. (Illinois Agriltural Experiment Station, Urbana, Illinois.)

Post-emergence chemical control of weeds in sweet corn. Taylor, Clifford E. Twelve varieties of sweet corn were planted on May 27 on silty clay loam soil, with post-emergence treatments applied July 1 and 2. The sweet corn varieties included Spancross, Surprise, Carmelcross, Golden 60-Day, Our Choice, Golden Sunshine, Golden Cross Bantam, Surecross, Lincoln, Marcross, Golden Bantam and Ioana. Treatments (all per acre, and in 100 gals. water per acre unless otherwise noted) were Na-2,4-D at ¼, ½, 3/4, 1, 1¼, 1½, 1 3/4 and 2 lbs., NH_4-DNOSBP at ½, 3/4 and 1 lb. and KOCN at 2, 3 and 4% in 60 gals. water per acre, plus checks. At the time of application the soil surface and vegetation were dry with no rain 48 hours either before or after, and the temperature 91-99° F. The corn was 18-28" high, and the nozzles were dropped to avoid the central whorl of corn leaves. Weeds were mostly purslane (Portulaca oleracea) to 4" high and pigweeds (Amaranthus spp.) to 14" high. Both the corn and weeds were growing vigorously and very succulent. Weed control with the Na-2,4-D: purslane - none, pigweeds - ½ lb. up. The yield of Golden Cross Bantam was significantly reduced by the Na-2,4-D at 1 3/4 and 2 lbs. There were no other significant yield reductions from any Na-2,4-D rate on any sweet corn variety. Stalk curvature occurred on most varieties but could not be correlated with yield data at the various rates. Varieties resistant to stalk curvature: Carmelcross, Golden 60-Day, Golden Cross Bantam, Our Choice and Surecross. Intermediate: Spancross and Golden Sunshine. Susceptible: Surprise, Lincoln, Marcross, Golden Bantam and Ioana. There was some "burning" of both the weed leaves and the lower corn leaves at the higher KOCN and NH_4-DNOSBP rates, with lowered (usually significant) yields. (Illinois Agricultural Experiment Station, Urbana, Illinois.)

Pre-emergence chemical control of weeds in various vine crops. Taylor, Clifford E. Table Queen and Green Delicious squash, Hearts of Gold muskmelon, Marketeer cucumber, Kleckley Sweet No. 6 watermelon and field pumpkins were planted June 2 on clay loam soil, with pre-emergence treatments applied June 8 and emergence June 10-12. There were no weeds present at the time of treatments, with the soil surface dry, sunny, and the temperature 45-65° F. For the prior week the mean temperature was 68° F. and the rainfall: 6/3 - 0.68". For the next two weeks the mean temperature was 71° F. and the rainfall: 6/14 - 0.61", 6/15 - 3.82" and 6/21 - 0.03". Weeds were 97% purslane. Treatments (all per acre, and in 100 gals. water per acre unless otherwise noted) and the percent weed control for each after 4 weeks: xanthogen disulfide at 10 lbs. - 0%, Na-PCP

at 20 lbs. - 62%, NH_4-DNOSBP at 5 lbs. - 75% and at 8 lbs. - 85%, Na-2,4-D at ½ lb. - 63% and Stoddard solvent at 50 gal. per acre plus PCP at 5 lbs. per acre - 16%. The percent control of purslane was 0, 61, 77, 86, 63 and 14%, respectively. Weed control was not significant with the xanthogen disulfide and fortified solvent, but highly significant with the other treatments. The Na-2,4-D and fortified solvent plots were discontinued. None of the crops were significantly reduced in stand by the xanthogen disulfide or Na-2,4-D treatments. The only treatments giving significant weed control and which did not significantly reduce stand and/or yield: Table Queen squash - none, Green Delicious squash - none, muskmelon - none, pumpkin - Na-PCP at 20 lbs., and the cucumber - NH_4-DNOSBP at 5 lbs. Stands were not significantly reduced on the watermelons by the two rates of NH_4-DNOSBP, but yield data was not available. (Illinois Agricultural Experiment Station, Urbana, Illinois.)

Pre-emergence chemical control of weeds in potatoes. Taylor, Clifford E. Early Ohio, Pontiac, Red Triumph, Chippewa, Katahdin and Rural New Yorker potatoes were planted on May 12 on clay loam soil, with emergence May 31- June 3. Pre-emergence treatments were applied on May 25. There were no weeds present at the time of treatment, with the soil surface moderately dry, cloudy and the temperature 42-48° F. For the prior week the mean temperature was 56° and the rainfall 5/18 - 0.25", 5/19 - 0.31", 5/20 - 0.89", 5/22 - 0.05" and 5/24 - 0.02". For the two weeks following the mean temperature was 63° F. and the rainfall: 5/26 - 0.01", 6/3 - 0.68" and 6/4 - 0.02". Weeds were 93% purslane (Portulaca oleracea) plus some lamb's quarters (Chenopodium album) and pigweeds (Amaranthus spp.). Treatments (all per acre, and in 100 gals. water per acre) and the percent weed control of each after 6 weeks: Na-2,4-D at ½ lb. - 27%, at 1 lb. - 25% and at 2 lbs. - 69%, xanthogen disulfide at 10 lbs. - 78%, Na-PCP at 20 lbs. - 84% and NH_4-DNOSBP at 6½ lbs. - 90%. Control of purslane was 24, 26, 68, 82, 83 and 91%, respectively. Weed control was not significant with the two lower rates of Na-2,4-D and these plots were discontinued. There was moderate temporary leaf curling at the 2 lb. rate of Na-2,4-D on the Pontiac and Rural New Yorker potatoes. The yields of Chippewa and Rural New Yorker potatoes were significantly lowered by Na-2,4-D at 2 lbs. There were no other significant effects on yields of any variety from any treatment. (Illinois Agricultural Experiment Station, Urbana, Illinois.)

Post-emergence chemical control of weeds in potatoes. Taylor, Clifford E. Early Ohio, Pontiac, Red Triumph, Chippewa, Katahdin and Rural New Yorker potatoes were planted on May 12 on clay loam soil, with emergence May 31-June 3. Post-emergence treatments were applied on July 1, 7-10 A.M., sunny, the temperature 75-89° F. and the soil surface and vegetation dry. Mean temperature the prior week was 76° and the rainfall totaled 0.46". For the following week the mean temperature was 78° F. and the rainfall - 0.89". The potatoes were 18-24" tall, with Chippewa in flower and Katahdin showing buds. The predominate weed was purslane (Portulaca oleracea), which were up to 6 inches tall with some in bud, plus some pigweeds (Amaranthus spp.). Treatments (all pounds per acre, and in 100 gals. water per acre) included Na-2,4-D at ¼, ½, 3/4, 1, 1¼, 1½, 1 3/4 and 2 lbs. plus checks. There was no control of purslane at any rate of Na-2,4-D. There was some control of pigweed at ½ lb., with complete control at 1 lb. In all cases control seemed especially slow, uncertain and difficult to classify. All varieties at all Na-2,4-D rates showed moderate to severe curling of leaves and young stems within 24 hours after application, and all varieties showed some degree of foliar deformity until harvest. At all Na-2,4-D rates the Early Ohio and Red Triumph potatoes considerably outyielded weeded-cultivated checks. Katahdin yields were about the same on the spray plots as the checks. In contrast the yields of Pontiac, Chippewa and Rural New Yorker were significantly lower than the checks at most Na-2,4-D rates. (Illinois Agricultural Experiment Station, Urbana, Illinois.)

Average percent weed control obtained from various pre-emergence treatments on field plots. Taylor, Clifford E. Weed control obtained with any pre-emergence herbicidal treatment is influenced considerably by both environment and kinds of weeds. Weeds on our vegetable experimental plots have averaged 88% purslane (Portulaca oleracea), 7% pigweeds (Amaranthus spp.) and some lamb's quarters (Chenopodium album), smartweeds (Rumex spp.), annual grasses and others. In a total of 233 plots given various pre-emergence herbicidal treatments, the treatments (per acre basis) and average percent weed control were as follows: Na-2,4-D at ¼ lb. - 28%, ½ lb. - 58%, 1 lb. - 70%, 1½ lbs. - 74%, 2 lbs. - 77% and 4 lbs. - 82%, Na-PCP at 15 lbs. - 78%, 20 lbs. - 81% and 25 lbs. - 84%, NH_4-DNOSBP at 5 lbs. - 74%, 6½ lbs. - 91% and 8 lbs. - 83%, zanthogen disulfide at 5 lbs. - 30% and 10 lbs. - 47%, and Stoddard solvent at 50 gals. fortified with PCP at 5 lbs. - 58%. Control of purslane: Na-2,4-D at ½ lb. - 66%, 1 lb. - 58%, 1½ lbs. - 84% and 2 lbs. - 82%, Na-PCP at 15 lbs. - 73%, 20 lbs. - 69% and 25 lbs. - 85%, NH_4-DNOSBP at 5 lbs. - 84%, 6½ lbs. - 91% and 8 lbs. - 87%, xanthogen disulfide at 5 lbs. - 58% and 10 lbs. - 36% and Stoddard solvent at 50 gals. plus PCP at 5 lbs. - 40%. Control of pigweeds: Na-2,4-D at ½ lb. - 55%, 1 lb. - 79%, 1½ lbs. - 79%, 2 lbs. - 96% and 4 lbs. - 100%, Na-PCP at 15 lbs. - 98%, 20 lbs. - 100% and 25 lbs. - 98%, NH_4-DNOSBP at 5 lbs. - 52%, 6½ lbs. - 77% and 8 lbs. - 82%, xanthogen disulfide at 10 lbs. - 45% and Stoddard solvent at 50 gals. plus PCP at 5 lbs. - 85%. Control of lamb's quarters: Na-2,4-D at ½ lb, - 77%, 1 lb. - 76% and 1½ lbs. - 92%. Control of smartweeds: Na-2,4-D at ½ lb. - 16%, 1 lb. - 50% and 1½ lbs. - 51%. (Illinois Agricultural Experiment Station, Urbana, Illinois.)

Effects of temperature and moisture on weed control obtained with various pre-emergence herbicides on vegetable plots. Taylor, Clifford E. Temperature, rainfall and soil moisture data were recorded as each series of pre-emergence herbicidal treatments was applied. Weed control on a total of 159 plots of Na-2,4-D at ½, 1 and 1½ lbs., Na-PCP at 20 lbs., NH_4-DNOSBP at 6½ lbs. and xanthogen disulfide at 10 lbs. per acre treatments were correlated with weather factors. The overall average on the weeds was 88% purslane (Portulaca oleracea), 7% pigweeds (Amaranthus spp.), and some lamb's quarters (Chenopodium album), smartweeds (Rumex spp.), annual grasses and others. Temperatures on the day of application and in the few days following application may conceivably affect the dissipation or reaction of the chemical film on the soil surface, and temperatures around the treatment date have a considerable effect on the relative proportions of dormant and germinating weed seed. With Na-2,4-D temperatures above 70° F. on the day of pre-emergence treatments and the days before and after gave markedly better weed control. Weed control with Na-PCP and xanthogen disulfide was slightly better when the mean temperature was above 70° F. the days before and below 70° after application. Control with NH_4-DNOSBP was considerably better when the mean temperature was below 70° F. both before and after treatments. Moisture appeared to be the most important weather factor in the percent of weed control obtained from pre-emergence treatments. Moisture affected the surface chemical film in relation to its depth, rate of downward movement, rate of dilution and inactivation. Moisture also affected the relative numbers of dormant or germinating weed seeds. Weed control with Na-2,4-D was much better when the rainfall was less than one inch the week before application and more than one inch the week or two following. Control with Na-PCP and NH_4-DNOSBP was markedly better when more than an inch of rainfall occurred the week prior to application and less than an inch in the following period. Xanthogen disulfide seemed especially critical of the moisture factor, giving effective weed control only when the rainfall was above an inch in the week before application and less than an inch in the two weeks following. (Illinois Agricultural Experimental Station, Urbana, Illinois.)

Residual toxicity of herbicides applied at pre-emergence rate levels. Taylor, Clifford E. The following treatments were applied on replicated field plots on July 1 (all as active ingredient, per acre): Na-2,4-D at 1, 2, 3 and 4 lbs., Na-PCP at 15 and 25 lbs., NH_4-DNOSBP at 5 and 8 lbs., xanthogen disulfide at 5 and 10 lbs. and Stoddard solvent at 50 gals. fortified with PCP at 5 lbs. Five flats of soil from the upper three inches of soil surface were removed from each field treatment on October 10 (100 days from treatment date). The following test vegetables were planted in each flat: Purple Top White Globe turnip, Va. Blight Resistant spinach, Southport Yellow Globe onion, Tendergreen snap beans, Wisconsin 55 tomato, Hollow Crown parsnip, Our Choice sweet corn and "A & C" cucumber. The soil was a silty clay loam of excellent texture. Total rainfall for the 100 days was 9.71" and the mean temperature 70° F. There were no significant reductions in emergence or stand of the eight test vegetables. The seedlings were thinned to uniform stands and then permitted to grow 6-8 weeks before harvest. Plant growth (fresh plant weight) was significantly reduced on the turnips, sweet corn, cucumbers and tomatoes from the 2, 3 and 4 lb. rates of Na-2,4-D, with the cucumber growth also reduced from the fortified solvent treatment. The growth of snap beans, spinach, parsnips and onions showed no significant effects from any of the soil treatments. (Illinois Agricultural Experiment Station, Urbana, Illinois.)

Pre-emergence use of NH_4-DNOSBP on sweet corn and peas. Taylor, Clifford E. Golden Cross Bantam sweet corn and Alaska peas were planted in an experiment with variables including planting at 1½ and 2½ inches deep, heavy and normal watering, application of NH_4-DNOSBP immediately after, 3 days after and 6 days after planting and at 4, 6½ and 9 lbs. per acre rates, plus checks for both depths of planting and both rates of watering, giving 40 treatments replicated 3 times. There was no significant stand reduction for either the sweet corn or peas from any treatment. Fresh plant weight after 6 weeks for the sweet corn showed significant reductions at 1) 1½" deep, heavy watering, application 6 days after planting at both the 6½ and 9 lb. rates, 2) 2½" deep, average watering, application on planting date at 9 lbs. and 3) 2½" deep, heavy watering, application 6 days after planting at the 9 lb. rate. At the late application date the sweet corn after emergence was wilted-appearing and tended to collapse, and the leaves tended to remain furled. On the peas fresh plant weight after 6 weeks showed a significant reduction at the 1½" deep, average watering, 9-lb. on planting date treatment, and in most of the treatments applied just before emergence at the 6½ and 9 lb. rates. In these cases the peas were just at or under the soil surface and the growing tips were killed back. In about ten days growth resumed from a lateral growing point located about a half inch below the soil surface, and subsequent growth was normal. The data indicates that deeper planting and application midway between planting and emergence favor the successful pre-emergence use of NH_4-DNOSBP in sweet corn and peas, with the amount of watering after treatments making little difference. (Illinois Agricultural Experiment Station, Urbana, Illinois.)

Pre-emergence weed control in red beets with TCA and PCP. Tibbitts, T. W. and Holm, L. G. Beets (Asgrow Canner) were planted on July 28 on Miami silt loam soil in a three replication randomized test. All of the chemicals used in the experiment were applied on August 1. Rainfall amounting to 0.1" fell during the 72 hours following treatment. Pigweed (Amaranthus retroflexus) was the predominant weed in the area. Stand counts of both beets and weeds were made on September 22 and the plots, with the exception of the unweeded control, were maintained free from weeds thereafter. The beets were harvested on October 20. TCA (sodium salt) was applied at the rate of 12, 16 and 20 lbs. of acid equivalent per acre in 40 gals. of water. The stands of weeds were reduced to 76, 32

and 28 per cent respectively of the unweeded control. There was little variation in the yield of beets at the three different rates but the two higher concentrations reduced the stands significantly. The yield of the treated plots was about 80 per cent of that from the weeded control. PCP (sodium salt) was applied at the rate of 8, 12, and 16 lbs. of active ingredient per acre. The weed stands were reduced by 34, 47, and 21 per cent respectively. The yields and numbers of beets per plot were reduced significantly by the 12 and 16 lb. treatments. The 8 lb. treatment caused some reduction in the number of beets and the yield was about 80 per cent of that from the weeded control. The following combinations of TCA and PCP were also included in the experiment: TCA 8 lbs. mixed with 2, 4, and 8 lbs. of PCP; TCA 12 lbs. with 2 and 4 lbs. of PCP; TCA 16 lbs. with 2 and 4 lbs. of PCP; and TCA 20 lbs. with 2 lbs. of PCP. All of these treatments gave excellent weed control and did not reduce the beet stands significantly. With the exception of the combinations listed below, however, they all reduced the yield of beets by 30 to 50 per cent. Sixteen lbs. of TCA with 2 lbs. of PCP and 20 lbs. of TCA with 2 lbs. of PCP gave yields which were lower than the controls but not significantly so. The 8 lbs. of TCA and 2 lbs. of PCP permitted a yield equal to the weeded control. In view of the relative effectiveness of PCP on broadleaves and TCA on grasses, it would appear that the tolerance of red beets to the above combinations is worthy of further investigation. (Dept. of Horticulture, University of Wisconsin, Agr. Exp. Sta., Madison, Wis.)

Crabgrass control in muskmelons. Warren, G. F. Purdue 44 muskmelons transplanted May 15 into a fine sand soil were sprayed June 6 with TCA (sodium salt) at 2 and 4 lbs., maleic hydrazide at 4 lbs., dichloral urea at 6 and 12 lbs., and N-1-naphthyl phthalamic acid at 2 and 4 lbs. per acre. Treatments were replicated 4 times and all materials were applied in water at the rate of 50 gals. per acre. At the time of application, the muskmelons were in bloom but no fruit had set and all weeds had been removed by cultivation and hoeing. Several showers of less than one-half inch each occurred during the three weeks after spraying. Dichloral urea at 12 lbs. and N-1-naphthyl phthalamic acid at both rates gave 75 to 80 per cent reductions in crabgrass (Digitaria spp.) counts made August 22. Dichloral urea at 6 lbs. gave a 55 per cent and TCA at both 2 and 4 lbs., a 42 per cent reduction compared with the check. The maleic hydrazide treatment resulted in a large increase in the crabgrass population which was apparently due to the fact that this treatment stopped growth of the muskmelon plants for about three weeks resulting in less shading of the ground. The other treatments caused little or no apparent injury to the muskmelon foliage. The total yield of melons was not significantly affected by any treatment except maleic hydrazide which resulted in almost a complete crop failure. However, maturity was delayed considerably by TCA at the 4 lb. rate. N-1-naphthyl phthalamic acid and dichloral urea were the most promising materials included in this experiment for the control of crabgrass in muskmelons. (Dept. of Horticulture, Purdue University, Agr. Exp. Sta., Lafayette, Ind.)

Crabgrass control in sweet potatoes. Warren, G. F. Yellow Jersey sweet potatoes transplanted May 8 into a fine sand soil were sprayed May 16 with TCA (sodium salt) at 2 and 4 lbs., dichloral urea at 6 and 12 lbs., maleic hydrazide at 4 lbs., IPC at 8 and 16 lbs., and N-1-naphthyl phthalamic acid at 2 lbs. per acre. Treatments were replicated 4 times and all materials were applied in water at the rate of 50 gals. per acre. Only a small percentage of the crabgrass (Digitaria spp.) had emerged when sprays were applied. Rainfall totaling 1.05 inches occurred May 21. TCA at 4 lbs., dichloral urea at both rates and N-1-naphthyl phthalamic acid gave 85 to 90 per cent reductions in crabgrass counts made June 15. TCA at 2 lbs. gave a 65 per cent reduction. IPC at both rates and maleic hydrazide did not significantly reduce the number of crabgrass plants

present. Weeds were removed from all plots on June 15 and a second count made July 6. Dichloral urea at both rates and N-1-naphthyl phthalamic acid gave 65 to 75 per cent reductions in the number of crabgrass plants that emerged between June 15 and July 6. The other treatments did not give counts significantly lower than the check. TCA and dichloral urea caused severe distortion of the sweet potato leaves, the injury being most severe at the higher rates of application. The plants resumed normal growth after six to ten weeks. Maleic hydrazide stopped growth of the sweet potatoes completely for about three months. N-1-naphthyl phthalamic acid caused slight formative effects from which the plants recovered quickly. IPC had no visible effect on the foliage. The yield of No. 1 sweet potatoes was significantly reduced by TCA at 4 lbs., dichloral urea at 12 lbs., and maleic hydrazide. N-1-naphthyl phthalamic acid at 2 lbs. per acre was the most promising treatment included in this experiment for control of crabgrass in sweet potatoes. (Dept. of Horticulture, Purdue University, Agr. Exp. Sta., Lafayette, Ind.)

Pre-emergence weed control in direct-seeded tomatoes. Warren, G. F. A replicated experiment was conducted on a medium colored silt loam soil in which crabgrass (Digitaria spp.), yellow foxtail (Setaria lutescens) and pigweed (Amaranthus retroflexus) were sown broadcast on May 9. Rutgers tomatoes were seeded directly in this field immediately afterward. On May 23, PCP (9.4 per cent in oil) at 2½ and 5 gals. per acre, sodium isopropyl xanthate at 8 and 16 lbs., DNOSBP (phenol) at 0.5 and 1 lb., PEC (formulation of a polychloro aryl-alkyl carbonate) at 2 gals., TCA (sodium salt) at 2 and 4 lbs., TCA at 2 lbs. combined with PCP (9.4 per cent in oil) at 2½ gals., and TCA at 2 lbs. combined with sodium isopropyl xanthate at 8 lbs. were applied in 50 gals. of water per acre. Most of the pigweeds but only a few of the grasses had emerged at time of treatment. Over one inch of rain fell a few hours after the treatments were applied, and tomatoes emerged from 1 to 3 days later. Weed and tomato stand counts were made four weeks after spraying and all plots were then thinned and hoed. TCA alone or in combination with sodium isopropyl xanthate killed 70 to 80 per cent of the grasses and severely stunted the remainder. Control was good but counts somewhat higher where TCA was combined with PCP. No other treatments gave appreciable control of grasses. All treatments gave from 70 to 85 per cent reductions in pigweed counts except TCA alone at both rates, sodium isopropyl xanthate at 8 lbs., and DNOSBP at 0.5 lbs. which gave less than 60 per cent reductions. The tomato stand was reduced 30, 50, 56, 87 and 90 per cent by 2½ gals. PCP, 5 gals. PCP, 2 gals. PEC, 0.5 lbs. DNOSBP and 1 lb. DNOSBP respectively. No other treatments significantly reduced the stand. TCA, especially at the 4 lb. rate, caused some stunting and chlorosis of the tomato plants early in the season. DNOSBP at both rates were the only treatments that reduced the yield significantly. The treatments which showed most promise were those in which TCA at 2 lbs. per acre was combined with either PCP at 2½ gals. or sodium isopropyl xanthate at 8 lbs. (Dept. of Horticulture, Purdue University, Agr. Exp. Sta., Lafayette, Ind.)

Pre-emergence weed control in onions. Warren, G. F. and Ellis, N. K. A replicated experiment was conducted on Early Yellow Globe onions planted about 1¼ inches deep in muck soil on April 21. On May 6 (just before onion emergence) the following treatments were applied in 50 gals. of water per acre: 2,4-D (amine), 0.5 and 1 lb. per acre; disodium 3,6-endoxohexahydrophthalate, 1 and 2 lbs.; maleic hydrazide, 4 and 8 lbs.; IPC, 8 lbs.; PCP (9.4 per cent in oil), 2½ gals.; sodium isopropyl xanthate, 16 lbs.; TCA (sodium salt), 2 lbs.; and sulfuric acid, 5 per cent. A windstorm the day before treatments were applied killed all weeds that had emerged. There was practically no rain during the two weeks following treatment but about one inch of water was applied, by overhead irrigation on May 15. Weed counts were made June 6 and all plots were hand weeded thereafter.

Weed species present, in order of importance, were annual grasses, pigweed (Amaranthus retroflexus) and purslane (Portulaca oleracea). Disodium 3,6-endoxo-hexahydrophthalate at 2 lbs. per acre and 2,4-D at 0.5 and 1 lb. gave 55 to 65 per cent reductions in the total number of weeds. No other treatments reduced the weed population by over 40 per cent. None of the treatments caused any visible effect on the onions and there were no significant differences in yield between any of the treatments and the check. (Dept. of Horticulture, Purdue University, Agr. Exp. Sta., Lafayette, Ind.)

Post-emergence weed control in onions. Warren, G. F. and Ellis, N. K. Several replicated experiments were conducted on muck soil in 1949 and 1950 to study the effect of material, rate and time of application, and weather conditions on weed control and injury to Early Yellow Globe onions. Of the materials tested, 2 to 3 per cent sulfuric acid applied at the rate of 100 gals. per acre gave most consistent weed control with least injury to the onions. Pigweed, smartweed and ragweed were easily killed by this treatment if not over one inch tall and purslane was killed in the cotyledon stage. Lamb's quarters and annual grasses were not controlled. Phosphoric acid at 12 to 15 per cent gave similar results but would be much more expensive. Ten pounds of potassium cyanate applied in 50 or 100 gals. of water per acre resulted in about as good control as sulfuric acid when weeds were small and succulent but much poorer control when weeds were large or were less succulent. Several other materials were tried but none gave as good results as these. Onions were more resistant to injury in the "knee" or "loop" and in the one- or two-true-leaf stage than in the "flag" stage. They were more subject to injury at any stage of growth if the weather had been moist and cloudy during the two or three days before spraying. Reductions in yield were generally proportional to the amount of observed injury. Based on these experiments it seems wise to avoid spraying in the flag stage but otherwise to spray when the weeds are small. Spray concentration should be lower when growth is succulent than when the plants are hard. (Dept. of Horticulture, Purdue University, Agr. Exp. Sta., Lafayette, Ind.)

Post-emergence control of weeds in snap beans using a shielded boom. Wilson, J. D. and Bruner, H. E. Snap beans were planted in a sandy loam May 27. On June 19, the planting was divided into plots 2 rows wide by 100' long and sprayed with formulations of nine different herbicides. The crop was shielded by "U" shaped shields 20" long that traveled over the row. The front of the shield was elevated 1½" while the back was equipped with a 6" x 1" skid attached to the outside of the shield, dragged on the ground. A self-propelled wheelbarrow carried the equipment and was adjusted to travel at a steady 2 mph. The applications were all made at the rate of 50 gals. per acre. The herbicides used and rates per acre were as follows: Dow Selective, 3 gals.; Shell 130, 10 gals.; Endothal 3003, 1 gal.; Sulfasan, 2 gals.; PEC, 2 gals.; ME 3002, 10 lbs.; ME 3001, 10 lbs.; Santobrite, 10 lbs.; and Form A, 10 lbs. At the time of spraying the beans were 10" to 12" tall and there was a complete ground cover of weeds up to 6" tall including red root, purslane, galinsoga, smart weed, lamb's quarters, mallow and foxtail. No cultivation was used either before or after spraying. Observations made one week after spraying showed Santobrite and Shell 130 gave good weed control, but were somewhat injurious. Top performance was delivered by Sulfasan followed by Form A and Dow Selective. PEC and the two ME applications did not give satisfactory weed control. (Ohio Agr. Exp. Sta., Columbus, Ohio.)

Project V. New Herbicides

W. C. Dutton

Summary

One hundred and six abstracts on the so-called "new herbicides" were received and included under Project V. Several were received but not used as they did not come under the current interpretation of "new herbicides". Most of them dealt with the newer forms of 2,4-D and 2, 4, 5-T. The abstracts used covered 37 materials or groups of materials. A good many abstracts listed materials by code number or trade name only and considerable care was necessary to get them properly classified. Several materials could be reported only by code as their identity has not been disclosed and such materials will be discussed under code number. The following discussions are based on the evidence presented in the abstracts and the conclusions drawn should not be interpreted to mean that a material reported as unsatisfactory might not give excellent results in some other use. Many abstracts are indefinite in the statement of results so it is not possible to classify materials in many instances.

The number of experiments reported for each material is listed in parenthesis following the name of the material. This will enable the reader to judge results a little better.

Calcium cyanamide (6) gave indefinite results in pre-emergence applications on onions and excellent results in asparagus after cutting season but is reported to be unsatisfactory in general for pre-emergence use with small seeded vegetables. Monosodium cyanate (1) was not satisfactory in alfalfa seed fields. Potassium cyanate (26) gave poor weed control in seed alfalfa and flax, reduced yield of red beets, gave fair results in post-emergence treatments in gladiolus, poor results in sugar beets, on quack grass and on weeds in sweet corn. It gave fair to good results on crab grass in turf in four trials and is reported to be generally satisfactory as a pre-emergence treatment in small seeded vegetable crops. Its use was reported 12 times in onions and results were good in 8 instances, fair in 1 and poor in 3 cases, mostly on large weeds. KOCN seems to have much merit for use in onions and many vegetables.

Phosphoric acid (1) in onions gave results comparable to sulfuric acid. Alpha hydroxy b-trichloroethyl sulfonic acid (chlorosol A) (1) gave unsatisfactory results on quack grass. Lurick Mix, a combination of phenyl mercuric acetate and 2,4-D, gave no control of weeds in a pre-emergence test. Phenyl mercuric acetate (4) was reported as fairly good on crab grass in bluegrass in one test, excellent in one and poor in one. Fair results were obtained in one pre-emergence trial in gladiolus. Results in general were rather erratic. Sodium isopropyl xanthate (5) gave variable and no really good results on weeds and considerable crop injury to vegetables, including onions and tomatoes, and in alfalfa. Sodium dichloro ethyl sulfate (1) is promising for annual grasses but had unfavorable effects on corn. Polychloroaryl-alkyl carbonate (5) was used in soybeans, alfalfa, garden beans, potatoes and tomatoes. There were some 2,4-D like effects early in soybeans, good contact action but no residual effect in alfalfa, unsatisfactory in beans, good in potatoes and reduced stand of tomatoes.

N-1-naphthyl phthalmic acid (2) gave very good indications for crab grass control in muskmelons and sweet potatoes. There was no injury to melons and only slight temporary formative effects on sweet potatoes. Several variations of disodium 3,6-endoxohexahydro phthalate (22) gave variable results in weed control and effects on plants. All formulations will be discussed as a group. Much of the data is not very specific and is hard to interpret. Several workers reported little or no effect on weeds, presumably broad-leaved, but in other cases 50 to 70 per cent control was indicated. Fair to good grass control was rather general and wild oats were controlled to some degree in several tests. It was effective against purslane in one instance. Reports on crop tolerance are hard to interpret but it is reported as causing injury to oats, soybeans, beets, cucumbers, lettuce, carrots and strawberries. Others report no injury to peas, corn, sunflowers, soybean, potato, beets and onions. These materials obviously need further careful study but present indications are that considerable injury to many crops may be expected.

Several materials, the identity of which has not been disclosed, are here discussed under code indentifications. EC-5722 (10) did not, in general, give satisfactory results. At rates of 1 and 2 lb./A. it had little or no effect on crops or weeds. Larger amounts, 4 to 12 lb./A., gave partial or full control of green foxtail and barnyard grass but had no effect on wild oats or quack grass. Unsatisfactory results are indicated where used in red beets, onions etc. with injury reported on onions from post-emergence treatments. EC-3890 (2) gave promising results on grasses in both pre- and post-emergence treatments but injured oats, corn and soybeans. EH-5678 (1), EH-5665 (1), EH-5669 (1), EH-568 (1) and EH-Mix (1) all gave promising indications for weed control. Form A (1) gave good weed control in beans without injury to crop when a shield was used. S-1998 (2) gave from 80 to 100% control of crab grass in turf without injury to bluegrass. L-2988 (1), L-2687 (1) and S-1980 (1) either failed to control crab grass or gave too much injury to desirable grasses.

Oils (7) such as kerosene, diesel, aromatic and special products gave variable results. Kerosene controlled crab grass in bluegrass. Esso 45 and Amsco D gave good weed control without injury to onions. Aromatic and various special oils gave excellent results in several vegetable and field crops as pre-emergence treatments. Aromatic oils are rated as one of the best materials for such use in small seeded vegetables.

Dichloral urea (14) seems to have some merit against grassy weeds. Against Johnson grass 100 lb. is about equal to 50 lb. of TCA but residual effect against seedlings of Johnson grass is better than TCA and residual toxicity to crops is also greater. Quack grass was not as well controlled as with TCA. 2½ to 12 lb./A. gave from 16 to 75% reduction in annual grass in a few tests but many trials resulted in no weed control and in some injury to crops.

Isopropyl-N-phenylcarbamate (13) was, in nearly all cases, reported as giving unsatisfactory results. 2 to 6 lb./A. generally was

innefective against grasses as well as broad-leaved weeds. It is suggested in one instance as an emergency treatment in vegetables for small annual grasses. Chloro isoprypyl-N-phenylcarbamate (2) is indicated as unsatisfactory for weedy grasses in corn and crab grass in turf.

Sodium 2,4-dichlorophenyl "cellosolve" sulfate (11) gave rather contradictory results in various experiments. Control of grasses and purslane was reported in one instance, control of weeds in corn and in one instance good weed control in onions was reported. Some injury to onions and beans was indicated. In several experiments results were entirely unsatisfactory.

Pentachlorophenol (22) in some combination with oil reduced the yield of gladiolus, reduced stand of red beets, caused injury to spinach, killed orinjured onions grown from seed, reduced yeild of horseradish, was injurious to beans and beets and was unsatisfactory in tomatoes, field crops and vine crops. It gave good control of grass and broad-leaved weeds in peonies with no injury to peonies, was safe in onions grown from sets, and was safe and effective in potatoes, and is recommended as useful on some large seeded crops. It is reported as being unsafe on small seeded vegetables. Sodium penta chloro phenate (29) was used on many crops with variable results. Post and pre-emergence treatments gave some good and some poor weed control but caused from slight to severe injury of onions grown from seed, red beets, many small seeded vegetables, peas and beans. In other instances it was safe and reasonably effective in corn, tomatoes, horseradish, potatoes, popcorn and vine crops but in several cases there was poor weed control. A combination of NaPCP and TCA seems very promising on red beets.

Sodium trichloro phenol (3) gave good results in post-emergence treatments on onions when a protecting shield was used. Sodium tetrachlorophenate (3) used with shields on onions gave similar results but seems to be a little less safe. Sodium ortho phenyl phenate (1) used in this way reduced stand of both weeds and onions.

Ethyl xanthogen disulfide (26) has given very few really good results. Of 21 pre-emergence trials 14 gave weed control ranging from 0 to 50%, four trials gave from 51 to 80% control and three more were indicated as good or satisfactory. One report indicates it to be very sensitive to environmental factors. Slight to severe injury was reported on spinach, flax, oats, red beets and onions.

2-Methyl-4-chlorophenoxy acetic acid (12) was used as the sodium and amine salts and the butyl and isopropyl esters. The most outstanding result is that MCP is definitely safer on peas than 2,4-D and for such use low rates of a salt formulation appear very promising. Another interesting development is the better control of purslane with MCP than with 2,4-D. Its use is very doubtful on alfalfa seed fields except possibly in early season. It was ineffective on leafy spurge, was more active than 2,4-D on Ladino clover and was not

equal to 2,4-D for weed control in corn. Considerable effectiveness against Canada thistle was indicated. Its status in grain is not clearly defined.

Maleic hydrazide (33) was the most widely used new herbicide and it obviously has interesting characteristics but does not seem at this time to fit well into any standard weed control practice. It has shown the characteristic, first reported for it, of depressing or inhibiting growth without killing the plants. In general, it does not exhibit marked selectivity. One interesting attempt with it was to produce sterile tassels in corn. Rates high enough to give sterile tassels resulted in serious injury to the corn.

Project V. New Herbicides

Abstracts of Individual Cooperators.

The use of Aero Cyanate (potassium cyante) as a herbicide in onions. Andersen, E. T., and Shadbolt, C. A. Applications of Aero Cyanate at 8, 16, 24, and 32 pounds per acre rates were made to Ebenezer onions grown for Dutch set production. A wetting agent (Nonic 218, Sharples Chems. Inc.) was applied with one set of treatments. Application was made while the onions were in the crook stage. Weeds present at the time of treatment were mustard (Brassica arvensis), stinkweed (Thlaspi arvensis), wild buckwheat (Polygonum convolvulus), and great ragweed (Ambrosia trifida) all in the 2-leaf stage, and wild oats (Avena fatua), and perennial sow thistle (Sonchus arvensis), also in small stages. Differences between treatments without and with the wetting agent were very slight. The 16 pound treatment gave a satisfactory control of mustard, stinkweed, and wild buckwheat, the latter being the most resistant. Wild oats and sow thistle were resistant to all rates. Great ragweed was controlled only at the 24 and 32 pound rates. At harvest time, the yields of onions from the 16 pound treatments compared favorably with the yields from the 24 and 32 pound rates, and with the cultivated checks. This was in agreement with the weed count records which showed little additional advantage to be gained from the higher rates. (Plant Science Division, The University of Manitoba, Winnipeg.)

Pre- and post-emergence weed control with onions on muck soils. Alban, E. K. and Lester Alley. During the 1949 and 1950 seasons, pre-emergence treatments with xanthogen disulfide at 25 lbs.; PCP at 5, 10 and 12 lbs.; and Stoddard solvent (12 to 18 per cent aromatic) at 50, 80 and 100 gals. per acre rates, were applied just prior to emergence of onions. Post-emergence treatments with 1.0, 1.5, 2.0, and 2.5 per cent KOCN; 0.5, 0.75, 1.0, and 2.0 per cent SPCP; and C. & C. No. 5722 at 4 lbs. were applied at 50 or 80 gals. per acre at various intervals from time of emergence of onions to within two weeks of harvest. All plots were cultivated as needed, but only the hand-weeded checks and the pre-emergence treatments were hand-weeded regularly. A randomized split block with five replications was used in both seasons, with Brigham Yellow Globe and Sweet Spanish varieties being included in the 1949 season but only Brigham Yellow Globe in the 1950 season. None of the post-emergence treatments compared favorably with the hand-weeded checks. KOCN and C & C No. 5722 did not control weeds, and with the exception of the two lower rates of KOCN, resulted in mild to severe damage to the onions in both seasons. Good to excellent control of all weeds was obtained with all four SPCP sprays, but the damage to onions was excessive in both seasons. Stoddard solvent at all three rates produced the most consistent weed control with none to only slight damage to onions. Xanthogen disulfide was used only during the 1949 season and compared favorably to Stoddard solvent. PCP treatments varied from mild to severe damage to onions in both seasons, with good to excellent weed control. The major value noted with successful pre-emergence treatments was the elimination of one hand weeding and the ease of first cultivation

as compared with hand weeded check. (Ohio Agr. Exp. Sta.)

Pre-emergence herbicides in vegetable crop production. Alban, E. K. During the last four years, 26 kinds of vegetables and approximately 100 varieties of vegetables have been included in pre-emergence chemical weed control studies in the field and in the greenhouse under various environmental conditions. Muck and silt loam to clay loam soils were the major soils included in these studies. The major chemicals were: 2,4-D (esters, amines, and sodium salt); IPC; STCA; PCP; SPCP; KOCN; DNOSBP; ADNOSBP; TADNOSBP; ethyl xanthogen disulfide; calcium cyanamide; aromatic oils, varying from 10 to 18 per cent aromatic content: and diesel fuel combined with PCP or DNOSBP. Based on weed control and crop tolerance, the following evaluation of the herbicides studied under Ohio conditions are presented. Pre-emergence treatments with 2,4-D have been consistently successful with only potatoes, sweet corn, and asparagus. PCP, SPCP, DNOSBP, ADNOSBP, TADNOSBP, calcium cyanamide, and diesel fuel combinations with PCP or DNOSBP, can not be safely used as a pre-emergence treatment on such crops as carrots, beets, onions, cabbage, cauliflower, broccoli, parsnips, lettuce, endive, turnip, tomato, and radish. The latter group of chemicals can be used with some degree of safety as a pre-emergence treatment on the large-seeded crops such as lima and snap beans, peas, sweet corn, cucumber, muskmelon, potatoes, and asparagus plants. Ethyl xanthogen disulfide has produced such variable results and weed control has in general been so inadequate that it can not be recommended. KOCN and aromatic oils have produced the most consistent, safe weed control measure used as a pre-emergence contact spray on such crops as onions, spinach, beets, carrots, tomato, turnip, endive, lettuce, and direct-seeded asparagus. Both of these chemicals have proven extremely valuable as a pre-emergence contact spray on small- and large-seeded vegetable crops where emergence of weed seedlings allowed spraying before emergence of crop seedling. IPC and STCA would appear to have a limited application as pre-emergence sprays for vegetables. Specificity of IPC for purslane suggests its use as a layby treatment for onions, asparagus, potatoes and sweet corn. STCA and IPC could also be considered as an emergency measure for control of small annual grasses in asparagus. (Ohio Agr. Exp. Sta.)

Pre-emergence weed control with potatoes on muck and upland soils. Alban, E. K. During the 1948, 1949 and 1950 seasons, Irish Cobbler, Katahdin, Chippewa and Russet Rural varieties of potatoes were grown on muck soils, and Wooster silt loam, Brookston silt loam and Miami silt loam. Pre-emergence chemical weed control treatments were applied at various intervals from time of planting to just prior to emergence of the potatoes. Chemicals with per acre rates included; 2,4-D at 1.0, 1.5 and 2.0 lbs. (acid equiv.) of alkyl ester, sodium salt, and polypropylene glycol butyl ether ester; xanthogen disulfide at 15.0, 20.0, and 25.0 lbs.; DNOSBP at 10.0 lbs.; SPCP as a 3.0 per cent solution; and PCP at 5.0, 10.0 and 16.0 lbs. Not all of the above mentioned variables were included on all soil types or for every season. DNOSBP at 10.0 lbs.; PCP at 10.0 and 16.0 lbs.; and SPCP as a 3.0 per cent solution applied just prior to emergence of Irish Cobbler and Katahdin potatoes, on muck soil, produced excellent weed control which was comparable or

slightly superior to check plots which had a spike tooth weeder treatment. There was no evidence of damage to either variety and no significant difference in yield. Xanthogen disulfide did not damage Irish Cobbler or Katahdin potatoes but weed control was very poor as compared with check. Application of 1.0 and 2.0 lbs. alkyl ester of 2,4-D and 2.0 lbs. sodium salt of 2,4-D on Irish Cobbler, Katahdin, Chippewa and Russet Rural, 10 days after planting and before emergence of potatoes has never resulted in damage to potatoes and weed control has been excellent, on upland soils. However when the same rates or slightly higher rates are applied at time of planting or just at emergence of potatoes, poorer weed control follows the former and increased evidence of damage to plants is apparent with latter. This damage is particularly striking with variety Russet Rural, and usually resulted in lower yields. Control of crabgrass and foxtail is obtained with the ten day treatment and very seldom obtained with either the earlier or the later 2,4-D treatment. The polypropylene glycol butyl ether ester of 2,4-D at 1.5 lbs. on Irish Cobbler and Katahdin just prior to emergence of potatoes on muck soils resulted in some mild symptoms of 2,4-D damage, but potatoes recovered and excellent weed control was obtained. (Ohio Agr. Exp. Sta.)

Effect of potassium cyanate and monosodium cyanamide on alfalfa seed fields. Alex, J. F., J. L. Bolton, R. T. Coupland and W. J. White. Potassium cyanate at 15 and 30 pounds per acre and 41.5% monosodium cyanamide x 5 at 50, 100 and 150 pounds per acre were applied to an 11-year old stand of alfalfa at Nipawin, Saskatchewan, at two stages of development. Stage 1, on May 26 when alfalfa was 3 inches high and the weeds (Axyris amaranthoides and Chenopodium album) were 1 to 2 inches; stage 2 on June 24 when height of alfalfa was 18 inches, of Axyris 3 to 6 inches and of Chenopodium was 4 inches. The chemicals were applied to duplicate plots with a knapsack sprayer in 100 gallons of solution in the May treatment and 74 gallons of solution per acre in June. Neither treatment was effective in appreciably reducing stand of weeds. No damage to alfalfa plants occurred from the first treatment. Slight damage occurred from the second treatment of both chemicals at the lowest rates, slightly heavier damage resulted from monosodium cyanamide at 100 and 150 pounds and moderate damage resulted from the 30-pound rate of potassium cyanate. Recovery was complete by September in all plots except the 30-pound rate of potassium cyanate and here it was well advanced. Except for a 20% reduction at 150 pounds of monosodium cyanamide, the May treatments had no effect on alfalfa seed production. The June treatment of potassium cyanate had no effect on seed yield, while monosodium cyanamide at 50 and 100 pounds reduced it to about two-thirds of the check and the 150 pound rate to one-third that of the check plots. These chemicals may be useful in controlling susceptible weeds in alfalfa but were of little use with the weeds present. (Contribution of the Dept. of Plant Ecology, University of Saskatchewan and the Dominion Forage Crops Laboratory, Saskatoon.)

Effect of MCP on alfalfa seed fields. Alex, J. R., R. T. Coupland, J. L. Bolton and W. J. White. MCP sodium salt at 3, 6, 9, 12 and 15 oz. of acid per acre and MCP butyl ester at 2, 4, 6, 8, and 10 oz. of acid per acre were applied to an 11-year old stand of Grimm alfalfa in two stages of development. Stage 1, on May 26 when the height of alfalfa was 3 inches and of weeds (Axyris amaranthoides and Chenopodium album) was 1 to 2 inches; stage 2, on June 24 when the respective heights were 18 inches (alfalfa), 3-6 inches (Axyris), and 4 inches (Chenopodium). Application was made to duplicated plots by a hand-powered wheel sprayer delivering 7.1 gallons per acre. Butyl ester in the May treatment resulted in no reduction in weeds at 2 oz., 35% reduction at 4 and 6 oz. and 75 to 100% reduction at 8 and 10 oz. rates. Control by the sodium salt at this stage was 10, 25, 35, 85 and 10%, respectively, with treatments of 3, 6, 9, 12 and 15 oz. In the second stage weeds were completely removed by all treatments except sodium salt at 3 oz. which reduced the stand by 75%. No damage to alfalfa plants resulted from the first stage of treatment, except with butyl ester at 8 and 10 oz. in which case recovery was complete by September. The second treatment (June) caused severe damage at all rates and recovery was not made by September except at the lowest rate of each chemical. At the first stage (May) 2 oz. of butyl ester and 3 and 6 oz. of sodium salt had little or no detrimental effect on seed yield of alfalfa and 12 and 15 oz. of sodium salt reduced the yield about 25%, while 4, 6, 8, and 10 oz. of butyl ester reduced it by 50% or more. The

June treatment eliminated seed production at all rates above the lowest rate of each chemical. The 2 oz. butyl ester plots produced a few seeds, the 3 oz. sodium salt plots produced about 30% of the checks. Sodium salt at 9 to 12 oz. per acre in an intermediate stage may have been less damaging to alfalfa and more effective on weeds. It seems more promising than butyl ester of MCP and comparable to 2,4-D amine. (Contribution of the Department of Plant Ecology, University of Saskatchewan and the Dominion Forage Crops Laboratory, Saskatoon.)

Post-emergent chemical treatments for weed control with sugar beets. Andersen, E. T. and Shadbolt, C. A. Applications of 3001 (Sharples Chems. Inc.) at 4, 8, 12, and 20 pounds of active ingredient per acre gave 100 per cent complete control of all weeds and destroyed all beets. At 2 pounds per acre, about 75 per cent of wild oat plants (Avena fatua) were destroyed, with about 50 per cent of the beets surviving the treatment. 3740 (Sharples Chem. Inc.) at 1 quart per acre killed nearly 100 per cent of the green foxtail (Setaria viridis), but did not affect wild oats or beets. At 4 quarts per acre the vigor of the beets was slightly reduced, and only very slight injury to the wild oats was evident. At 8 quarts, the beet stand was reduced by 50 per cent, and both green foxtail and wild oats were completely eradicated. 5722 (Carbide and Carbon Chems.) at 1 pound per acre showed no effect upon the wild oats, green foxtail or beets. At 6 and 12 pounds per acre, there was nearly a complete kill of green foxtail, with no effect upon wild oats or beets. Maleic hydrazide applied at 8 pounds per acre caused a gradual destruction of wild oats, green foxtail, and beets, which was complete after 5 weeks. At 4 pounds, the beets were severely stunted, but not killed and weeds were controlled 100 per cent. Sodium chloride applied at 100 pounds per acre gave unsatisfactory control of broad leaved annuals. At 200 and 300 pounds per acre good control of annuals, mostly mustard (Brassica arvensis) was obtained. There was no effect upon wild oats or perennial sow thistle, and only a slight reduction in beet vigor. Polybor gave results similar to those of sodium chloride. 480 pounds per acre was required to control the broad-leaved weeds. The beets at this rate were not injured. (Contrib. of Division of Plant Science, The University of Manitoba, Winnipeg.)

Pre-emergent chemical treatments for weed control with sugar beets. Andersen, E. T. and Shadbolt, C. A. Screening tests were again conducted with sugar beets in co-operation with the North Central Weed Control Conference. ACP 646, ACP 638, and ACP 472 were found to be extremely injurious to the beets, causing extreme symptoms typical of 2,4-D treatments. ACP 644 applied at 2, 4 and 8 pounds per acre appeared to give good control of wild oats Avena fatua, with little effect upon green foxtail (Setaria viridia) or the beets. Maleic hydrazide at 4 pounds per acre caused serious injury to the beets, and gave complete control of wild oats, and green foxtail. A slight chlorotic effect was observed on perennial sow thistle, Sonchus arvensis following this treatment. Sulfosan (Monsanto Chem. Co.) at 10 pounds per acre destroyed 50 per cent of the emerged broad-leaved annual weeds, with

no effect upon the beets. Sodium TCA resulted in a gradual reduction in vigor of the wild oats, which finally died about 6 weeks after treatment. Sinox at 1, 2 and 3 pounds per acre applied in 40 gallons of diesel oil per acre gave good control of wild oats, which had emerged at time of treatment. There was no effect on the beets. Premerge at 3, 6 and 9 quarts per acre applied on June 16 gave good control of wild oats, with no effect on the beets. In a similar treatment applied on July 13, made on a later planting of beets, the beets and wild oats were both eliminated entirely. For several days following the first treatment the weather remained dry, whereas with the second treatment, rain fell the day following. (Contrib. by the Division of Plant Science, The University of Manitoba, Winnipeg.)

Some effects of maleic hydrazide on plants. Andersen, E. T., and Shadbolt, C. A. Maleic hydrazide was applied to a very heavy stand of wild oats (Avena fatua) about 6 inches in height at 12, 24, and 36 pounds per acre. The first evidence of injury was a darkening of the foliage after about 10 days. In from 5 to 6 weeks, all the wild oats were dead with all treatments. Maleic hydrazide was applied to a planting of Ebenezer onions and rape (var. Dwarf Essex) at 6, 12, and 24 pounds per acre. The onions were in the flag stage, and the rape in the 4-leaf stage. The rape gradually weakened and died with all treatments. The onions were killed with the 24 pound treatment, and were reduced to about a 50 per cent stand with the other two rates. Those remaining appeared normal in all respects. Maleic hydrazide was applied, post emergently, to sugar beets in the 4-leaf stage, at 4, 8, and 12 pounds per acre. Green foxtail (Setaria viridis) and wild oats were sown with the sugar beets, and were in the 4-leaf stage when treated. Wild oats and green foxtail gradually weakened and were completely dead one month after treatment at all dates. The beets responded in much the same way as the grasses when treated at the 8 and 12 pound rates, and were severely stunted at the 4 pound rate. Maleic hydrazide appeared to have a very slow action, requiring from 5 to 6 weeks to effect a complete destruction of some plants. It seemed to be somewhat selective for onions and sugar beets. (Contrib. by the Plant Science Divison, The University of Manitoba, Winnipeg.)

The effect of maleic hydrazide on various vegetable crops. Barnard, E. E. Jr. and Warden, R. L. Maleic hydrazide was applied to randomized, four replicated plots of Dark Red Detroit beets, Tendersweet carrots, Straight Eight cucumbers, New York No. 12 head lettuce, Yellow Globe onions (sets), and King of Denmark spinach. Near optimum germination conditions prevailed for three weeks following planting on May 25. Applications of .1 and .5% active ingredient in 50 gallons of water per acre were made on June 26, at which time germination had been completed for a week. Clear weather followed application for seven days. Since the effect of the material on the crops was the object of this experiment the weeds were suppressed mechanically and the plots were thinned, sprinkler irrigated, and maintained with normal gardening practices. Beet and spinach yields at the .1% rate and onion and carrot yields at both rates were nearly the same as those of the check plots.

Cucumber yields were 75% and 70% of the check at the two rates but the reduction is not significant. Highly significant yield reductions occurred at the .1% rate with 34% in lettuce, and at the .5% rate with 35% in beets, 76% in lettuce, and 55% in spinach. A bolting increase in lettuce was noted with the check showing 2% bolting, the .1% rate 13% bolting and the .5% rate 68%. In addition the lettuce from the 12-pound rate exhibited leathery, distorted, outer leaves. The material caused slight tip burn and stunting on spinach at the .1% rate and much tip burning and stunting at the .5% rate. Cucumber plots receiving the .1% rate were delayed approximately 1/2 to 1 week while those receiving the .5% rate were 1 to 1½ weeks later than the check. (Contribution of The Montana Agricultural Experiment Station.)

The effects of sodium isopropyl xanthate on weeds and various vegetable crops. Barnard, E. E. Jr. and Warden, R. L. Goodrite NIX was applied to randomized, four replicated plots of Dark Red Detroit beets, Tendersweet carrots, Straight Eight cucumbers, New York No. 12 head lettuce, Yellow Globe onions (sets), and King of Denmark spinach one week after seeding. Near optimum germination conditions prevailed for three weeks after planting on May 25. At the time of treatment the spinach and lettuce were about 10% germinated and the onions were about 40% sprouted. Six-tenths of an inch of rain fell during the week following application and before complete emergence. Stand counts of weeds and vegetables were made four weeks later. Thereafter, the weeds were suppressed mechanically and the plots were thinned, sprinkler irrigated, and maintained with normal gardening practices. Only a 15-pound active ingredient per acre rate of application was made due to the excessive foaminess of the material supplied for the remaining rates of application. Weeds (red root pigweed, fanweed, wild mustard, and Setaria spp.) were suppressed about 60% by this treatment. Beet, carrot, cucumber and onion stands approximated those of their checks whereas spinach exhibited a 25% increase and lettuce a 21% reduction. The yield of onions was nearly the same as its check, while beet and carrot yields were 10% and 9% higher than theirs. Cucumber, spinach and lettuce yields were reduced 9%, 14% and 26%. The stand count and yield for lettuce are significant at the 5% level. (Contribution of the Montana Agricultural Experiment Station.)

The effects of disodium 3, 6-endoxohexahydrophthalate on weeds and various vegetable crops. Barnard, E. E. Jr., and Warden, R. L. 3,6-E (E.C.-3740) was applied to randomized four replicated plots of Dark Red Detroit beets, Tendersweet carrots, Straight Eight cucumbers, New York No. 12 head lettuce, Yellow Globe onions (sets), and King of Denmark spinach one week after seeding. Near optimum germination conditions prevailed for three weeks after planting on May 25. At the time of treatment the spinach and lettuce were about 10% germinated and the onions were about 40% sprouted. Six-tenth of an inch of rain fell during the week following application and before complete emergence. Stand counts of weeds and vegetables were made four weeks later. Thereafter, the weeds were suppressed mechanically and the plots were thinned, sprinkler irrigated, and maintained with normal gardening practices. Weeds (red root pigweed,

fanweed, wild mustard, and particularly Setaria spp.) were suppressed about 50% by treatments of 2 pounds per acre and about 70% by treatments of 4 pounds per acre. Beets and cucumbers exhibited stands approximating those of the check plots. Spinach stands were 145% and 127% of the check at 2 pounds and 4 pounds respectively. Lettuce and carrots had stands of 60% and 51% at the 2-pound rate and 44% and 24% at the 4-pound rate, which were highly significant reductions. Yields of onions and spinach were nearly the same as the check plots, whereas beets yeilded 113% and 123% at 2 pounds and 4 pounds per acre, the latter being a significant increase. Cucumbers, lettuce and carrots yielded 74%, 38% and 61% with the 2-pound treatment, and 34%, 15% and 30% with the 4-pound treatment, all computations being percents of yields of the checks. All, except the cucumber yield at 2 pounds per acre, show highly significant reductions. A bolting increase in lettuce was noted with the check bolting 2%, the 2-pound rate 15%, and the 4-pound rate 30%. Cucumber plots receiving 2 pounds per acre were approximately one week later while those receiving 4 pounds per acre were from 1½ to 2 weeks later than the checks. (Contribution of the Montana Agricultural Experiment Station.)

The effects of various herbicides on weed control, stands and yields of Netted Gem potatoes. Barnard, E. E. Jr. and Warden, R. L. Netted Gem potatoes were planted in randomized, three replicated plots on May 16. Near optimum germination conditions prevailed for four weeks after planting. On June first, the following pre-emergence sprays were applied: 3,6-E (E.C.-3740), 2, and 4 pounds active ingredient per acre; 2,4-D (Sodium 2,4-dichlorophenoxyacetate) 1 and 2 pounds acid equivalent per acre; Premerge 4 and 6 pounds active ingredient per acre. Stand counts of weeds and potatoes were made June 26. Thereafter, the weeds were suppressed mechanically so that differential herbicidal effects could be measured, and the plots were sprinkler irrigated and maintained with normal practices. On June 26th Maleic hydrazide was applied at .1% and.5% active ingredient in 50 gallons of water per acre. At this time emergence had been completed for about two weeks. Weeds (red root pigweed, fanweed, wild mustard, and Setaria spp.) were suppressed by the treatments as follows: 3,6-E, 2 pounds, 55%; 4 pounds, 71%; 2,4-D, 1 pound, 72%; 2 pounds, 91%; Premerge, 4 pounds, 84%; and 6 pounds, 86%. The potato stands for all treatments approximated those of the check. Yields of No. 1 potatoes for all treatments except Maleic hydrazide approximated those of the check. Maleic hydrazide depressed yields at the .1% rate 12%, and at the .5% rate 83%, the latter being highly significant. At the .1% rate it slightly increased tuber set and slightly reduced tuber size. At the .5% rate set was increased 124% and size of No. 1's was lowered 45%. On a size basis, 65% of the tubers of the check were No. 1's, whereas at the .5% rate only 8% were No. 1's. Many second growths and many aerial tubers developed at the .5% rate. (Contribution of the Montana Agricultural Exp. Station.)

Growth of purslane, Portulaca oleracea, following treatment with 2,4-D, 2,4,5-T and MCP. Buchholtz, K. P. A nearly pure stand of purslane was treated with the isopropyl esters of 2,4-D, 2,4,5-T and MCP at the rates of 0.125, 0.25 and 0.50 lbs. per acre.

Applications were made on July 8, 1950 when the purslane plants had stems about 2 inches long using 40 gallons of spray per acre. Four replicates were used. Plots were harvested on August 3 and fresh weights of purslane were recorded from a 2 sq. ft. quadrat in each treatment. Check plots produced an average of 55 gms. of fresh purslane tissue per sq. foot. All treated plots produced significantly less fresh weight than check but MCP was most effective in reducing purslane growth, followed by 2,4,5-T and 2,4-D. The average yields as percent of check were 8, 25 and 43 percent respectively for MCP, 2,4,5-T and 2,4-D. The 0.25 lb. per acre application of MCP, 2,4,5-T and 2,4-D reduced purslane weights to 5, 20 and 30 percent of check, respectively. It appears that MCP is considerably more effective in reducing the growth of purslane than either 2,4-D or 2,4,5-T when applications are made to immature top growth. (Dept. of Agronomy, University of Wisconsin, Madison, Wisconsin.)

Responses of quackgrass to applications of five herbicides. Buchholtz, K. P. On May 10, 1950, TCA, dichloral urea (E.H. 2), and the sodium salt of alpha-hydroxy b-trichlor ethyl sulfonic acid (Chlorosol-A) were applied at rates of 20, 40 and 80 lbs. per acre to a dense quackgrass sod on soil of the Miami silt loam type. Maleic hydrazide and Herbicide 5722 were applied at rates of 5, 10 and 20 lbs. per acre. All of the chemicals except E. H. 2 were applied in water equivalent to 80 gallons per acre. E.H. 2 was applied as a slurry using 320 gallons of water per acre. The plots were one half sq. rod in size and 4 replicates were used. During May, June and July 21.4 inches of rain were received. At the time of application the quack had made about 5 inches of top growth. On May 17 estimates were made of the extent of leaf kill. TCA applied at 80 lbs. per acre had caused about 45 percent of the leaf tissue to become brown and dry. The 20 lb. application of Herb. 5722 had affected about 20 percent of the leaf tissue and Chlorosol-A when applied at 80 lbs. had affected about 10 percent. Maleic hydrazide and E.H. 2 had caused only minor responses. On July 14 estimates of stand remaining were made. Chlorosol-A, Herb. 5722 and maleic hydrazide had not reduced stands significantly on this date. The 20, 40 and 80 lb. applications of TCA had reduced stands to 75, 48 and 25 percent of check while stands of quack on plots treated with E.H. 2 were 78, 58 and 23 percent of check. Maleic hydrazide at 10 and 20 lbs. per acre had checked growth and reduced heading to less than 10 percent of check on this date. By October 3 recovery had occurred so that the infestations on plots treated with the 20, 40, and 80 lb. applications of TCA and E.H. 2 were up to 95, 93, 58, and 100, 95 and 80 percent of check respectively. Of the materials tested TCA appeared the most promising for quackgrass control. (Dept. of Agronomy, University of Wisconsin, Madison, Wisconsin.)

Yields and tenderometer readings of canning peas following treatment with 2,4-D and MCP. Buchholtz, K. P. Shoshone peas were planted on May 19, 1950 and treated on June 19 when they were about 12 inches high but before bloom had started. The sodium salt and an amine preparation of 2,4-D as well as an amine preparation of MCP were each applied at rates of 0.125, 0.25 and 0.5 lbs. per acre in water equivalent to 40 gallons per acre. Plots contained 18 sq. ft. and four replicates were used. At the time of treatment a mod-

erate number of redroot (Amaranthus retroflexus) about 2 inches high were present in all plots. On July 20 the peas were harvested, shelled weights obtained and tenderometer readings determined. Untreated checks yielded 2687 lbs. per acre. All of the treated plots except the 0.125 lb. application of MCP yielded significantly less than check. Plots treated with 0.125, 0.25 and 0.5 lbs. of MCP yielded 2929, 1946 and 1435 lbs. per acre respectively. The sodium salt and amine preparations of 2,4-D were more toxic to the peas giving average yields of 1544 and 1127 lbs. while the average yield of plots treated with MCP was 2105 lbs. Tenderometer readings were not affected significantly by any treatment and average 74 in this experiment. A later harvest date would have increased yields materially but differences due to treatment would probably have remained comparable. Redroot was controlled effectively by all materials and all rates used although the 0.125 lb. rate did not kill many of the plants. MCP appears to be more promising than 2,4-D for use as an herbicide in peas. (Department of Agronomy, Univ. of Wisconsin, Madison, Wisconsin.

Response of canning peas to applications of TCA, maleic hydrazide and IPC. Buchholtz, K. P. Alaska peas planted on May 11, 1950 were treated on June 7 when about 6 inches high with the sodium salt of TCA, maleic hydrazide and an emulsifiable preparation of IPC at rates of 2, 4 and 8 lbs. per acre of the chemical or acid equivalent. Plots contained 10 sq. ft. and 4 replicates were used. Applications were made in water equivalent to 40 gallons per acre. At the time of treatment moderate infestations of redroot (Amaranthus retroflexus) and foxtail (Setaria spp.) about 2 inches high were present in all plots. At canning stage the peas were harvested, shelled weights obtained and tenderometer readings determined. Pea yields were not affected significantly by the TCA or maleic hydrazide treatments and averaged 2407 and 2580 lbs. per acre. Check plots yielded 2975 lbs. per acre while those treated with IPC yielded an average of 2068 lbs., a significant reduction. The 8 lb. application of IPC was especially harmful, apparently due to the burning action of the oil carrier on the pea leaves rather than due to the IPC itself. Tenderometer readings were significantly affected by some treatments. All plots receiving TCA had higher readings averaging 121 in comparison to 117 for check. Plots treated with 8 lbs. of maleic hydrazide were significantly retarded in development and gave tenderometer readings of 105. IPC applications had little effect on pea maturity. Significant control of the foxtail was obtained by the 4 and 8 lb. applications of TCA and the 8 lb. application of maleic hydrazide. The later application also gave significant control of redroot. IPC was ineffective in controlling growth of either grassy or broadleaved weeds. (Dept. of Agronomy, Univ. of Wisconsin, Madison, Wisconsin.)

The selective control of wild oats in flax and in peas by TCA and maleic hydrazide. Carder, A. C. Five rates of TCA, nil, 10, 20, 40 and 60 pounds acetate equivalent per acre were applied to Redwing flax and Chancellor peas one day after they had been seeded in land heavily infested with wild oats (Avena fatua). Later, when the flax had emerged 1 inch, the peas 1½-2 inches and the wild oats 2 inches maleic hydrazide was applied at six rates: nil, 1, 2,

4, 8 and 12 pounds of the active ingredient per acre. Examination 2 months subsequent to treatment indicated that the wild oats were more susceptible to the pre-emergence TCA application than were either flax or peas and that the latter were intermediate to the wild oats and flax in their susceptibility. Ten pounds of TCA reduced the vigour of the wild oats 83 and that of the flax 45 per cent. The higher rates showed much less selectivity. Yield data, rendered extremely light by June drought and mid-August frost, indicated 19 and 64 per cent reduction in clean flax seed by the 10- and 20-pound rates, respectively. The post-emergence treatment of maleic hydrazide indicated a high susceptibility of flax to this chemical, while both peas and wild oats possessed moderate tolerance. Thus, 8 pounds of maleic hydrazide per acre stunted growth of flax to 5 per cent of that on the untreated controls, while the peas and wild oats retained 90 per cent of their vigour. (Contri. of Dominion Experimental Station, Beaverlodge, Alberta.)

Effect of maleic hydrazide on alfalfa and spring planted winter wheat. Corns, W. G. Different plots of Kharkov winter wheat planted in May and sprayed during the first week in September with 0.7, 1.4, 2.8 lb. maleic hydrazide (Naugatuck) and 1% Fab wetting agent in 20 gal. water per acre showed no visible response before freeze-up. Second year alfalfa sprayed in June at mid-flowering stage with 1, 2, 4, 8 lb. of chemical per acre exhibited flower damage from two higher rates, and leaves in these treatments became chlorotic one to two months later. (Contrib. Dept. Plant Science, Univ. Alberta, Edmonton.)

Weed control with E. H. #1 in new strawberry plantings. Denisen, E. L. and D. W. Staniforth. Dunlap strawberry plants planted in the spring of 1950 in a sandy loam soil were sprayed with 0, 2, 4 and 8 lbs. of E. H. #1 per acre on June 16 and July 7. The entire experiment of five replications was hand hoed prior to each spray application. The first spray of the 4 and 8 lb. treatments gave excellent control of purslane and grasses, the principal weeds present in the check plots. The 2 lb. rate also cut down the weed stand appreciably, but necessitated more hand hoeing than 4 and 8 lbs. Grasses were the more serious problem after July 7 and were controlled effectively by the 4 and 8 lb. applications. There was no reduction in plant stand for any of the treatments, however, the rooting of runners was inhibited to some extent. Runner counts on August 2 indicated a significant decrease in runner set. Rooting of runners was decreased by 28, 40 and 67% respectively for the 2,4 and 8 lb. treatments. Drouth conditions which prevailed following the July 7 spray may have been responsible to a considerable degree in reducing rooting of runners. However, counts taken on September 15, after a period of more precipitation, showed a significant reduction in runner set only for the 8 lb. treatment. These reductions were 13, 26 and 55% for the 2, 4 and 8 lb. treatments respectively. Production records will be taken in the spring of 1951. (Contr. by Iowa Agricultural Experiment Station, Ames, Iowa.)

Maleic hydrazide on sweet corn. Denisen, E.L. and E.S. Haber. MH was sprayed at 3 conc. and 2 dates on the female parent in a sweet corn crossing block in an attempt to promote sterility of anthers. Iowa inbreds 453 and 5125 were used as the male and female parents

respectively. MH was applied at 250,500, and 1000 ppm. of the active ingred. at the rate of approx. 60 gal./A. The 1st date of applic. was on June 30 when the growing points of the female plants were from 2 to 4" above the 1st node and the 2nd date July 12 when the growing point was 8 to 12" above the 1st node. The plots sprayed at the 1st date showed a marked reaction to the MH treatment. Tassel dev. was suppressed at each spray conc., however, 250 ppm. was not sufficient to prevent pollen shedding and 500 ppm. greatly dwarfed the tassel which had empty glumes except for a few at the basal part of the tassel which shed viable pollen later. The 1000 ppm. applic. seriously dwarfed the corn in addition to causing a weakly developed sterile tassel. The 2nd date of applic. was too late for effective control of tassels, however, the yields were reduced with the increases in conc. The yields of all treated plots were below those of the hand-detasseled check. Germ. tests on the seed produced on treated plants are being made. (Hort. Dept., Iowa Agr. Exp. Station, Ames, Iowa.)

Onion weed control with chemicals. Denisen, E.L., D.W. Staniforth and A.L. Bakke. A split plot exp. of 5 repl. combined pre-emergence and post-emergence treatments on Iowa Yellow Globe #44 onions grown on muck soil at Clear Lake, Iowa. Pre-emergence treatments consisted of Stoddard solvent, 100 gal/A; 2,4-D amine, ½ lb/A in 50 gal. H_2O; 2,4-D amine, 1 lb/A in 50 gal.; Na-PCP, 4 lbs/A in 50 gal.; Dow General, 1½ pts/A in 50 gal.; and 2,4-D Na salt, 1 lb/A in 50 gal. Post-emergence treatments consisted of KOCN (1% and 2% in successive applic.) and sulfuric acid (2%). Both materials were sprayed at the rate of 100 gal./A. A treatment consisting of deep cult. during midsummer was also compared to the hand-weeded check. All pre-emergence sprays except Stoddard solvent gave effective weed control, however, Na-PCP and Dow General gave a very marked reduction in stand of onions as well as a highly significant decrease in yield. Although the 1 lb. of 2,4-D amine gave slightly better weed control than the ½ lb. treatment, the yield was significantly reduced from the check. This indicates the desirability for determining a proper balance between effective weed control and reduced stand and/or yield. The post-emergence sprays both gave signif. reductions in yield, KOCN at the 5% level and H_2SO_4 at the 1% level. Both post-emergence sprays greatly reduced the weed population but also resulted in tip burn of the small onion plant. The deep cult. treatment gave only a slight reduction in yield during the cool summer of 1950. (Dept. of Hort. & Dept. of Botany & Plant Path., Iowa Agr. Exp. Sta., Ames, Iowa)

Maleic hydrazide on potatoes. Denisen, E.L. Kennebec potatoes were sprayed with 5 conc. of MH on 3 dates to determine the vine killing possibilities and the effect on yield and storage quality. Conc. of 375,750,1500,3000 and 6000 ppm. were applied on July 6, July 20 and July 28, 1950. Earlier maturity of the vines resulted with the 750 ppm. & higher conc. at all dates of applic. The 2 highest conc. of the 1st applic. stunted the plants very severely and resulted in the formation of numerous aerial tubers at the nodes. Yields of the 1st date of applic. showed a marked reduction with increasing conc. The reduction in yield on the 2nd date of applic. was considerably less than the 1st and the 3rd date of applic. showed no signif. reduction in yield at any of the conc. used. In addition to aerial tubers, the plants sprayed with 3000 and 6000 ppm. on the 1st date produced numerous tubers that were misshaped and very small in size. Specific gravities of the tubers produced showed no signif. differences between treatments or dates of applic. The tubers were placed in storage to determine their keeping qualities as a result of the spray treatments. (Hort. Dept., Iowa Agr. Exp. Station, Ames, Iowa)

An ecological study of the effects of 2,4-D, endothal and annual weeds on flax yields at Brookings, S. Dak. in 1950. Derscheid, Lyle A., J. M. Aikman. Quintriplicate 8' x 16' plots were seeded to Dakota flax in rows six inches apart. Three plots were kept weed-free, three were seeded to wild mustards and foxtails primarily, but some wild oats, wild buckwheat, shepherd's purse, lamb's quarter and sweet clover were also seeded. A seventh plot was seeded to the broadleaved weeds and an eighth to the grassy weeds. Plots 7 and 8 as well as one weed-free and one mixed weedy plot were not treated with chemicals but one weed-free and one mixed weed plot were treated with the alkanol amine of 2,4-D at the rate of 1/4 lb. of acid equivalent per acre and two similar plots were treated with 3/4 lb. of 3,6-endoxyhexahydrophthalic acid equivalent (endothal) per acre. Yields of flax straw, flax seed, broadleaved weed shoots and grassy weed shoots were taken from 4 rows 13 ft. long. The data were analyzed statistically. Flax seed and straw yields varied together and were not affected by either chemical. Mean yields of 22.8 bu/A and 0.63 T/A from weed-free plots were significantly higher than mean yields of 15.6 bu/A and 0.42 T/A from weedy plots. The yields of 18.9 bu/A and 0.51 T/A from grassy weed plots were significantly higher than the mean yields of 14.7 bu/A and 0.40 T/A from plot containing broadleaved weeds. The mean yield of broadleaved weeds of 0.47 T/A from 2,4-D treated plots was significantly lower than the mean yield of 0.65 T/A from untreated plots. The yield of grassy weeds of 0.15 T/A from endothal treated plots was significantly lower than the mean yield of 0.30 T/A of untreated plots. When grassy weeds were partially controlled with endothal, the broadleaved weed yield increased 0.19 T/A. Due to unusually cool and otherwise abnormal growing conditions, 2,4-D was not as effective as usual and therefore the effect of endothal may not have been typical. Enothal should therefore be tested further before it can be recommended for general use. (Contribution of Agronomy Dept. of South Dakota Agr'l. Exp. Sta. in cooperation with the Botany Dept. at Iowa State College.)

Maleic hydrazide on mixed grasses and weeds. Eskew, E. B. and Willard, C. J. A mixed grass border, predominately bluegrass, but including timothy, orchard grass, quackgrass, dandelions, buckhorn and common plantain, was used. Plots, 5' x 20', triplicated. Dates, weekly, beginning April 20, through June 16. Rates each date, 0, 2, 4, 6, and 8 lb./A. of MH, applied in 10 gallons water/A, with 0.03% Nonic wetting agent. Formulation, diethanoline amine salt. The 2-pound rate only partially inhibited growth of all grasses. The three June treatments were on turf mowed in May. No rate of MH produced any observable effect on any of the grasses on those dates. The 4-pound and higher rates in April and May inhibited growth and reproduction of bluegrass, and the 6- and 8-pound rates reduced the stand. Bluegrass developed a dark green color 10 to 14 days after spraying. May treatments had more effect than April on the later maturing grasses. Dandelions did not bloom when treated at 4 lb./A or more before buds began to open. Leaves present at early dates of treatment turned purple, then died, but new growth started about July 1. No observable effect on buckhorn or common plantain at any rate or date. Orchard grass became chloratic following all April and May treatments; new growth from crowns 8-10 weeks after treatment. Timothy leaves developed anthocyan pigment, 3

weeks after spraying and later died; new growth from haplocorms 8-10 weeks after spraying. Quackgrass became dark green, without other pigment; new growth from rhizomes about 8 weeks after treatment. All plots were clipped July 15 and appear to be making normal growth since. A plot treated at 8 pounds April 29 last year, which produced no heads and little growth all last season, looked normal in all respects this year. A plot at 10 pounds was slightly thinner. (Contribution of the Ohio Agricultural Experiment Station.)

Maleic hydrazide on oats. Eskew, E. B., and Willard, C. J. Triplicated plots, 4' x 20', of Clinton 59 oats were treated June 1 at rates of 0, 2, 4, 6, and 8 pounds of maleic hydrazide in 10 gallons of water per acre (0.03% wetting agent). On June 14 all treated plots had developed a dark green color, later becoming chlorotic and dying. Approximately 1/4 of the plants which were sprayed with the 2-pound application bloomed and set seed. Small alfalfa seedlings were apparently not affected by any of the rates. (Contribution of the Ohio Agricultural Experiment Station.)

Maleic hydrazide on corn. Eskew, E. B. and Willard, C. J. Duplicated plots of hybrid field corn, 7' x 20', were sprayed with maleic hydrazide at rates of 0, 2, 4, 6, and 8 pounds per acre in 10 gallons of water plus .03% Nonic 218 wetting agent. Sprayed June 16. Corn 7"-12" high (4-7 leaves). Growth inhibition observed 10 days later, and red pigmentation developed within 3-4 weeks at all rates. All plants finally died, except a few plants in the 2 lb. plots. Terminal leaves of these plants were chlorotic and showed absence of green tissue next the mid-rib. Tassels were variously affected, but pollen was produced by the few florets which were formed. Smut was prevalent on all parts of the surviving plants. Another treatment, corn 15" high (7-10 leaves), July 1, gave similar results. The terminal blades developed a chlorotic appearance and gradually died. Basal leaves remained green 3-4 weeks, then developed red pigment, fired along leaf margins, and finally died. New shoots developed from the bases of the plants 6 weeks after applications were made. (Contribution of the Ohio Agr'l. Exp. Sta.)

Maleic hydrazide on soybeans, millet, and rape. Eskew, E.B., and Willard, C. J. Plots containing a mixture of soybeans, rape, and millet were sprayed with maleic hydrazide at 0, 1, 2, 4 and 8 pounds per acre in 10 gallons of water with 0.03% Nonic 218 wetting agent. The plots were 6' x 12', triplicated, at three stages of growth. First stage, on July1, the plants 3" to 4" high. All three species inhibited by all 4 rates. Soybean leaves became chlorotic after 10 days at rates of 2 pounds or more. Later, small dead areas developed. The soybean stand was reduced by 4 and 8 pounds per acre, the surviving plants making little growth. Rape leaves developed purple pigment one week after spraying; later became chlorotic and in the 4 and 8 pound rates, about 50% of the plants died. Millet formed some seed heads at all rates; number and size of heads decreased as rate increased. A second treatment, same rates etc., July 16, plants 12"-15" high, gave similar results. The third treatment was after the millet and soybeans had bloomed, at rates of 0, 1/4, 1/2, 1 and 2 pounds per acre. All rates delayed maturity of the soybeans, but rape and millet were apparently unaffected. (Contribution of the Ohio Agr'l. Exp. Station.)

Effect of several herbicides used for control of weedy grasses in growing corn. Finnerty, D. W. Seven chemicals were applied to corn in place of a final cultivation July 21. Materials were applied in water at 80 gpa. Spray touched only the lower part of the corn stalk. Three replications in a randomized block design were used. Chemicals and rates were: Dow Premerge, 3 and 6 qts. per acre; Carbide and Carbon E.H. #1, 4 pounds; IPC, 3 and 6 pounds; chloro IPC 3 and 6 pounds; Sodium PCP, 12 and 16 pounds; 2,4-D free acid, 2 pounds; and 2,4-D amine, 2 pounds. Soil was moist, corn and weeds growing actively at time of treatment. Crabgrass and foxtails were in 2-leaf stage between corn rows and 2-leaf to heading in the rows. Observations September 12 showed four of the materials gave an estimated 50% or more control: Dow Premerge, 3 quarts, 50% control; 6 quarts, 60%; Sodium PCP, 16 pounds, 50% control; 2,4-D free acid, 2 pounds, 55% and 2,4-D amine, 2 pounds, gave 55% control. None of the treatments used appeared to affect the corn, except that corn in plots receiving 6 pounds of either IPC or chloro IPC was 3 to 4 feet shorter than untreated plants. (Contributed by Nebraska Agricultural Experiment Station.)

Effect of several chemicals applied as pre-emergence and post-emergence treatments on crabgrass in a bluegrass lawn. Finnerty, D. W. and N. E. Shafer. Eleven chemicals were used in four tests conducted at different periods throughout the summer of 1950. Timeliness of initial treatments and optimum time for retreatments were observed. Repeated applications of most chemicals were made to replicated plots in randomized blocks. Extremely dry weather during June and subsequent cool, damp weather during July and August could have affected the results of the tests. Foliage treatments were: kerosene, 2 and 3 quarts per square rod; S 1998, 1 and 2 percent in 600 gallons water per acre; Aero cyanate 0.5 and 1.0 per cent in 150 gallons water per acre; Scutl, 4 pounds per 1250 square feet and 8 pounds per 1250 square feet; and maleic hydrazide, 0.2, 0.4, and 1.2 percent in 150 gallons water per acre. Pre-emergence treatments, which were all applied in 150 gallons water per acre, were: 2,4-D free acid, 2 and 3 pounds, 2,4-D amine, 2 and 3 pounds; Dow Premerge, 3 and 6 quarts; IPC, 3 and 6 pounds; Carbide and Carbon E.H.#1, 4 and 6 pounds; and chloro IPC, 3 and 6 pounds per acre. Rates, dates of application (initial and retreatments), and percent kill (based on head counts September 9) for treatments giving best control with negligible injury to bluegrass were; Dow Premerge, 6 quarts, May 16 and July 13, 98%; S 1998, 1%, May 22, June 22, and July 13, 86%; S 1998, 2%, May 22, June 22, 90%; kerosene, 2 quarts per square rod, July 13, 90% and kerosene, 3 quarts per square rod, August 11, 95%. Other treatments giving less satisfactory control were: Aero cyanate, 1.0%, May 22, June 22, 70%; Dow Premerge, 3 quarts, May 16, July 13, August 11, 73%; and Scutl, 4 pounds per 1250 square feet, July 24, August 2, August 11, 74%. All other treatments either were ineffective in controlling crabgrass or were too injurious to bluegrass. (Contributed by Nebraska Agricultural Experiment Station.)

Trials with MCP. Foster, J. Roe. Sodium salt and butyl ester forms of MCP were applied to Thatcher wheat, Exeter oats Montcalm barley and Royal flax at 4 and 16 ounces acid per acre. Wild mustard (Sinapis arvensis) was controlled 100% by both rates. Except for deformities in the heads of the wheat there was little damage to wheat, oats or barley. The flax was damaged and the stand reduced up to 30% with the 16 ounce rates. Heading was retarded 2 to 3 days by these rates. The sodium salt formulation gave somewhat better results than the ester from the standpoint of yield, particularly with oats and barley. (Contributed by the Dominion Department of Agriculture, Expt. Farms Service, Dominion Expt. Sub-Station, Regina, Saskatchewan, Canada.)

Trials with oil sprays. Foster, J. Roe. Three types of oil sprays were applied to wheat, oats, barley and flax at rates of 33 and 66 gallons per acre. The first was a deisel fuel with a low boiling point and an aromatic content of over 50%. The second was a similar oil with a low aromatic content of less than 15%. The third oil had a high boiling point and low volatility. The high aromatic oil was much more effective than the low aromatic oil in killing vegetation. The third oil having the low volatility gave similar results to the high aromatid oil, presumably because it stayed on the plant longer and therefore was active longer than the more highly volatile oils. The 66 gallon rates of the 1st and 3rd oils killed 100% of the vegetation, while an equal amount of the low aromatic oil killed 80% of the vegetation. (Contr. by the Dominion Dept. of Agriculture, Expt. Farms Service, Dominion Expt. Sub-Station, Regina, Saskatchewan, Canada.)

A study on the evaluation of herbicides for the control of leafy spurge (Euphorbia esula). Heggeness, H. G., and Miller, J. H. Twenty-one promising herbicides were sprayed on individual plots of leafy spurge, each of which was delimited by a furrow about 6 inches deep and 10 inches wide. A mixture of borax and polybor chlorate was placed in the furrow at a rate of 30 lb. per square rod to prevent roots from spreading into neighboring plots.. Herbicides selected for the study included maleic hydrazide, disodium 3,6-endoxyhexahydrophthalate, nine 2,4-D formulations, five 2,4,5-T formulations, two mixtures of 2,4-D and 2,4,5-T, and three MCP formulations. Based on fall observations, the following were considered promising for the control of leafy spurge: emulsified acid of 2,4-D, polypropylene glycol butyl ether ester of 2,4-D, dimethylamine salt of 2,4-D, isopropyl ester of 2,4-D, and 2,4-D acetanilide. The other chemicals were of questionable value or of little value for the control of leafy spurge. Since the extent of root kill could not be readily determined, it is essential to delay evaluation until after spring observations can be made. It was also observed that the herbicides varied in the time required for them to injure the leafy spurge, but this was not necessarily correlated with herbicidal properties. All herbicides injured the top growth of leafy spurge, but varied in their ability to reduce the vigor of the plants. (Contribution of Minnesota Agricultural Experiment Station and U.S.D.A. Bureau of Plant Industry.)

A comparison of certain chemicals with 2,4-D for weed control in strawberries. Hemphill, D. D. .E.H. 1, E.H. 2, maleic hydrazide, Endothal and 2,4-D were used as pre-planting and summer sprays (July and August) in strawberries. Each material was used separately and 2,4-D was also used in combination with each of the other chemicals. Pre-planting applications of E.H. 1, 4 pounds/acre, and E.H. 2, 12 pounds/acre, gave fairly satisfactory control of broad and narrow leaf weeds for approximately four weeks without apparent damage. Lower rates of these materials did not give satisfactory control. Endothal, 3 and 5 pounds/acre gave satisfactory control of broad and narrow leaf weeds but caused severe damage to the strawberry plants. A one-pound rate did not give satisfactory weed control. Maleic hydrazide 12 pounds/acre did not give control of broad or narrow leaf weeds. No serious injury to plants was evident at this rate. Amine salt 2,4-D 2 pound/acre acid equivalent helped considerably in weed control with no apparent injury to the strawberries. Some combinations of 2,4-D with other chemicals especially Herbicide 2 gave excellent weed control but considerable damage to strawberries resulted As summer sprays, E.H. 1, 1, 1½ or 2 pounds/acre and E.H. 2, 2, 4 or 6 pounds/acre did not give satisfactory weed control. Higher rates of these materials may give satisfactory weed control without serious damage to the plants. Endothal, ½ pound/acre, caused considerable damage and did not control weeds. Higher rates were too toxic. Maleic hydrazide showed no promise for summer sprays at rates up to 8 pounds/acre. Amine salt 2,4-D 1 pound/acre acid equivalent gave very satisfactory control of both broad and narrow leaf weeds. Combinations of 2,4-D and the other chemicals did not give better weed control than 2,4-D alone and decreased runner production. (Contribution from the Dept. of Horticulture, Missouri Agricultural Expt. Station, Journal Series No. 1234)

Chemical weed control in gladiolus. Holm, L. G. and Beck, G. E. On June 5 eighteen plots of gladioli consisting of four 12 foot rows each were planted in a Miami silt loam soil. Each row contained 20 corms of the White Gold variety, 6 of Lady Jane, 6 of Ethel Cave Cole, and 4 of Snow Princess. The chemical treatments described below were applied beginning on June 13, stand counts of weeds and crop were taken on August 3 and subsequent to that date two of the rows in each plot were kept free from weeds. The predominant weeds in the area were purslane (Portulaca oleracae), pigweed (Amaranthus retroflexus), barnyard grass (Echinochloa crusgaulli), lamb's quarters (Chenopodium album) and smartweed (Polygonum hydropiper). The corms were harvested on October 28. The following pre-emergence treatments were applied (all concentrations referred to below are in pounds per acre of acid equivalent or active ingredient of the appropriate compound): Sulfasan (ethyl xanthogen disulfide) 10 and 25 pounds; TCA (sodium salt) 15 and 30 pounds; methyl bromide (97.5 percent plus 2 percent chloropicrin) 1 pound per 100 square feet; PCP (sodium salt) 5 pounds; Pre-Merge (DNOSBP) 3 pounds; 2,4-D (sodium salt) 2.5 and 5 pounds; and a combination of chemicals consisting of PCP 5 pounds and TCA 15 pounds. Post-emergence sprays applied when plants were 5" high were as follows: 15 pounds of potassium cyanate with 1 pound of 2,4-D; and 15 pounds of potassium cyanate with an additional application at the same rate 3 weeks later.

Combination pre- and post-emergence treatments were as follows: TCA 15 pounds before emergence and 5 pounds 3 weeks later; Pre-Merge 3 pounds before emergence and again 3 weeks later; 2,4-D 2.5 pounds before emergence and 1 pound 3 weeks later; and phenyl mercuric acetate 4 pounds before emergence and 4 pounds 12 days later. Two check plots were included. The post-emergence treatments with potassium cyanate and the phenyl mercuric acetate applications reduced the weed stands by about 65 percent. All other treatments reduced the weed counts by about 80 percent. Yield data on spike and floret production was taken at fourteen separate harvests. The treatments effected no apparent delay in time of bloom production as compared with the controls. The total floret production in all plots was equal to or exceeded that of the controls and the total spike production per plot showed no marked reduction as a result of any of the treatments. Fewer florets were produced in the unweeded than the weeded rows of the plots. Corm yields and numbers could not be obtained in time for inclusion in this report. (Contrib. of the Dept. of Horticulture, Univ. of Wisconsin, Agr'l. Expt. Station, Madison, Wis.).

The response of red beets to pre- and post-emergence applications of herbicides. Holm, L. G. and Tibbitts, T. W. Asgrow canner beets were planted in a four replication randomized test on May 19 on a silt loam soil for the purpose of studying the response to pre- and post-emergence applications of herbicides. The initial application of the chemicals were made at the time when about 1 percent of the beets (based on ultimate stand) were beginning to emerge. Stand counts were taken on July 1 and the beets were harvested on August 30. The pre-emergence treatments, applied on May 27, and the post-emergence treatments (underlined), applied on June 18 were as follows: (all concentrations are in pounds per acre of acid equivalent or active ingredient of the appropriate compounds): ME 3003 (disodium 3, 6 endoxohexahydropthalate) at 2 and 2 pounds, ME 3003 at 4 and 4 pounds; 5722 (in oil) at 2 and 2 pounds, 5722 at 4 and 4 pounds, TCA (sodium salt) at 12 and 4 pounds, TCA at 20 and 8 pounds; Stoddard Solvent at 50 and 50 gallons, Stoddard Solvent 80 and 80 gallons; and potassium cyanate at 5 and 5 pounds. The latter treatment also included a 10 pound post-emergence application on July 1. The 2 and 2 pound and the 4 and 4 pound rates of ME 3003 gave significant reductions in yield of beets. This reduction was equivalent to 26 percent and 33 percent respectively. The stand of beets was not reduced significantly. 5722 and TCA showed no reductions in stand or yield at any of the concentrations used in this experiment. All applications of potassium cyanate and Stoddard Solvent caused highly significant reductions in yield. (Contrib. of Dept. of Horticulture, Univ. of Wisconsin, Agricultural Experiment Station, Madison, Wisconsin.)

Pre-emergence chemical weed control in red beets. Holm, L. G. and Tibbitts, T. W. Beets (Asgrow Canner) were planted in a four replication randomized test on May 19 on a Miami silt loam soil. The chemical treatments described below were applied on May 26 prior to emergence of the beets. At this date large numbers of seedlings of annual broadleaved weeds and grasses had emerged in the area. No precipitation occurred in the 72 hours following treat-

ment. On June 21 stand counts of beets and weeds were made and subsequently 1/2 of each plot was kept free from weeds. The chemical treatments were as follows (all concentrations are in pounds per acre of acid equivalent or active ingredient of the appropriate compounds): Shell 130 (PCP in oil) 5 and 10 gallons, diluted to 40 gallons per acre; ME 3003 (disodium 3, 6 endoxohexahydrophthalate) at 2, 4, and 8 pounds; EH 2 (Dichloral Urea) 2½, 5, and 10 pounds per acre; 5722 (in oil) 1, 2, and 4 pounds; IPC (Emulsifiable oil) 5, 10, and 20 pounds and Premerge (DNOSBP) 5, 10, 20 pounds. Premerge, Shell 130, 5722 and EH 2 in all concentrations either drastically reduced the yield of beets or failed to give effective weed control. Weed control provided by ME 3003 did not vary markedly with the concentrations used. In general weed stands were 50 percent of those in the check plots. The stand of beets was reduced but not to a significant degree. Five and 10 pounds of IPC caused no significant reduction in the stand of beets but failed to provide effective weed control. Twenty pounds of IPC provided a significant reduction in the stand of grasses with no reduction in broadleaved weeds. The stand of beets was significantly reduced, however. Yield data on beets was not significant due to the competition of the weeds remaining in the check plots and those in which weed control was poor. Similar results were obtained from an identical experiment which was conducted concurrently on a muck soil less than 1/2 mile away. (Contrib. of the Dept. of Horticulture, Univ. of Wisconsin, Agr'l. Expt. Station, Madison, Wisconsin.)

The effect of ME 3003 when applied as a pre-emergence treatment for the control of Purslane (Portulaca oleracae). Holm, L.G. The effectiveness of ME 3003 (disodium 3, 6 endoxohexahydrophthalate) in the control of purslane became evident when an abandoned lima bean weed control experiment was left untouched for a period of a about six weeks after the chemicals were applied. The lima beans were planted on June 12 on a Miami silt loam soil with a very low organic matter content. The pre-emergence chemical sprays were applied on June 15. Hard rains prevented emergence of the crop by packing the soil. The tightly-packed soil and favorable weather which followed were conducive to the production of a stand of weeds which were almost 100% purslane. On July 28 the plots (2' x 12') which had been sprayed with ME 3003 at the rate of 8 pounds of active ingredient per acre were free of the weed while at the borders of the sprayed areas the purslane was 4" to 8" high. At 4 pounds to the acre about 3 or 4 purslane plants appeared in each plot. The experiment contained three replicates. The rainfall during the first week following planting amounted to 3.11 inches, while the precipitation up to the time of observation totaled 16.26 inches. (Contrib. of the Dept. of Horticulture, University of Wisconsin, Agricultural Experiment Station, Madison, Wis.)

The effect of pre-emergence herbicides on weed control, stands and yields of spinach. Holm, L. G. Nobel spinach was planted in a four replication randomized test on May 16 in a dry Miami silt loam. On May 22, PCP (sodium salt) at 5 and 15 pounds of acid equivalent per acre, TCA (sodium salt) at 5, 10 and 20 pounds of acid equivalent, Sulfasan (ethyl xanthogen disulfide) at 15 and 25 pounds of active ingredient, and E.H. #1 (sodium dichloro-

phenoxyethyl sulfate) at 2 and 4 pounds of active ingredient were applied in 40 gallons of water per acre. Rainfall totaled 1.95 inches during the 72 hours after the treatments. A limited number of annual broadleaved and grass weeds had appeared at the time the materials were applied and approximately 5% (based on ultimate stand) of spinach seedlings were just emerging through the soil. After the weed and stand counts were taken, with the exception of the control, the plots were hand weeded for the remainder of the growing season. PCP 5 pounds, TCA 20 pounds, Sulfasan 25 pounds, and E.H. #1 2 pounds reduced the stands of weeds to 35, 64, 38, and 14 percent, respectively, of the unweeded control. The stands of spinach were thinned by the treatments and the yields, though not reduced significantly, were decreased to some extent. TCA at 10 pounds per acre caused some decrease in yield of spinach though not to a significant degree. The stand of spinach was not effected by this treatment and the number of weeds was reduced by 50%. An identical experiment was conducted concurrently on muck soil less than one-half mile away. The weeds in this area were predominately the annual broad leaved type. PCP 5 pounds, TCA, 20 pounds, and Sulfasan 25 pounds gave excellent weed control but reduced the stands of spinach significantly. On the muck E.H. #1 at 2 pounds per acre did not reduce the stand of spinach significantly but failed to provide the effective weed control it had exhibited on the upland soil. TCA at 10 pounds per acre again reduced the number of weeds by 50% and permitted a stand of spinach equal to that of the hand weeded plots. Yield figures were not obtained because the crop was destroyed by flood. (Contrib. of the Dept. of Horticulture University of Wisconsin, Agricultural Experiment Station, Madison, Wisconsin.)

Effect of maleic hydrazide on quack grass (Agropyron repens) in Dakota flax. Friesen, H. A. A water solution of the amine salt having 30 percent maleic hydrazide (with no wetting agent) was sprayed at three rates, viz: 2, 4 and 16 pounds of acid equivalent per acre on square rod plots of quack grass, on June 30, 1950. The quack grass was just coming into the "headed" stage at the time of treatments. The plots were on medium loam soil and on land that had been spring cultivated and sown to flax. These plots also had a light infestation of brome grass (B. inermis, Russian thistle S. kali, stinkweed T. arvense, and lamb's quarters C. album. The annual weeds were in the early bud stage. The 2 pounds per acre rate arrested the growth of the quack grass and by July 12, the plants had turned purple in color. These plants did not appear to recover and produce seed in 1950. However, healthy green regrowth from the roots by mid-August was as abundant as the original stand. Russian thistle and stinkweed showed signs of injury on July 4 and by mid August they had died. There was little visible effect on the flax plants while the possible effect on seed setting was obliterated by frost on August 15. Brome grass did not occur on this plot. The 4 pound rate gave essentially the same results as the 2 pound rate with the exception that regrowth of the quack was delayed until after mid September. The effect on the brome was slight, although some of the leaves turned purple in late July. At the 16 pound rate the quack and brome plants turned purple on July 4 and

and were apparently dead by August. Regrowth was limited to a few shoots of quack which appeared late in September. The annual weeds and flax on July 12 had developed a purple color with greatly swollen leaves and stems and in early August these plants were completely dead. Observations of interest were the slow action of the chemical and its short residual effect in the soil as measured by the abundant emergence in mid August and normal growth thereafter of stinkweed, Russian thistle and blue burr. (Contributed by the Dominion Experimental Station, Scott, Sask.)

The effect of IPC on quack grass (Agropyron repens) on land sown to Dakota flax. Friesen, H. A. IPC was applied in water at the rates of 2, 4, 6 and 8 pounds of acid equivalent per acre and in diesel oil at 4 and 8 pounds of acid equivalent per acre to quack grass approaching the heading stage. The plots were on loam soil on land that had been spring cultivated and sown to flax. Russian thistle S. Kali and stinkweed T. arvense in the bud stage were also found on these plots at the time of treatment. Moisture conditions were excellent throughout the season. IPC with water as a carrier gave very unsatisfactory control of quack grass at each of the rates used. The 2 pound rate had no visible effect on the quack grass, flax or annual weeds. The 4, 6 and 8 pounds per acre rates resulted in retarded vigor of growth of quack grass, flax and weeds. However by late July, one month after treatment, growth on the plots had returned to a normal appearance. Four days after the application of both the 4 and 8 pounds per acre rates with diesel oil as the carrier, the top growth of the quack appeared to be completely killed. The flax and annual weeds suffered very severe stunting. Regrowth of quack began appearing early in August and by mid October it was as heavy as the original stand. The flax was killed by frost on August 18. (Contributed by the Dominion Expt. Station, Scott, Sask.)

Effect of herbicides on annual weeds growing on land sown to wheat and on land in fallow. Friesen, H. A. Non-replicated plots (1/100 acre in size), heavily infested with wild buckwheat, Russian thistle, stinkweed and lamb's quarters were treated with various herbicides. Each herbicide at each rate was applied to one plot sown to Rescue wheat and to one plot on land which had been in fallow in 1949. The weeds were in the rapidly growing stage prior to budding and growing conditions were excellent at the time of treatment. The products used as well as the resulting weed kills in percent (based on visual estimates and weed counts) for the treatments made on land in crop, are given in the accompanying table. On the basis of the table the two low volatile esters, namely L.V.4 and H-1010 were the most effective weed killers. It was of further interest to note that the amines of 2,4-D appeared to be very slightly more effective on buckwheat than the esters. MCP sodium salt and MCP butyl ester and ACP 472 did not look promising because of the relatively poor kills of both Russian thistle and buckwheat; both weeds were wilted down by the chemicals but a large proportion of them recovered. ACP 646A wilted down each weed species in a matter of 2 hours, however, the buckwheat and some Russian thistle recovered within 2 weeks. The 2,4-D esters and amines, while not giving 100 percent kills of buckwheat, stunted

the surviving plants so severely that they made practically no further growth and set very little seed. Generally the kills of buckwheat were some 10 percent better in the crop than on fallow for comparable treatments. TCA, 2,4,5-T and IPC (in water) hold little promise as herbicides for the control of annual weeds. Yields were not available due to frost and weather damage. Some sterility was observed following the low volatile esters but the effect on yield could not be measured. TCA at each rate killed the grain. (Contributed by the Dominion Expt. Station, Scott, Sask.)

Effect of maleic hydrazide on vegetables. Friesen, H. A. and Howat, M. G. The diethanolamine salt of maleic hydrazide was sprayed as a water solution at 2 concentrations, viz: .25 and .50 per cent, on beets, chard, spinach, cucumbers, onions, peas, potatoes and tomatoes. The vegetables, except potatoes and tomatoes, were planted on June 30, and the treatments were made on August 5. Each concentration was applied in sufficient quantity to wet the foliage. A wetting agent, 1 cup of Dreft per 2 gal. of water, was used. Moisture and temperature factors were conducive to rapid growth. At each concentration there was no apparent effect on peas or onions. Beets and chard showed a marked reduction in vigor and a loss of 50 per cent in yield at the .5 conc. At the .25 conc., there was a temporary retardation of growth and a slight reduction in yield. Both concentrations resulted in temporary wilting and twisting of the spinach plants. There was a very slight reduction in the yield of spinach as a result of the heaviest treatment. Cucumbers were severely wilted and growth was arrested for a period of 5 days, after which time apparently normal growth was resumed. The treated and untreated plants were killed by frost on August 18. The potatoes, which had emerged 2 weeks prior to the time of treatment, were inhibited to the extent that the treated plants were almost 30 per cent shorter than the untreated plants. Growth of the treated plants had just been resumed when the vines were killed by frost. Essentially similar effects from the use of this chemical were observed when it was applied to tomatoes one month after transplanting. (Dominion Expt. Station, Scott, Sask.)

Several new herbicides on leafy spurge (Euphorbia esula) at pre-emergence state of growth. Kratochvil, D. E., James Hay, L. A. Derscheid and L. M. Stahler. Duplicate 16 x 16' plots of leafy spurge were treated at pre-emergence stage of growth with 1, 2, 4, 6, and 8 pounds acid per acre of the amine of 2,4-D, and 1, 2, and 4 lbs. of ethyl ester of 2,4-D, butoxy ethanol ester of 2,4-D, Dow H-1010, ACP-648, 2 methyl 4 Chloro phenoxyacetate, amine of 2,4,5-T Dow 2,4,5-T, pentasyl ester of 2,4,5-T, pentasyl ester of 2,4-D and the acetanalide of 2,4-D. The spurge was summer fallowed in 1949 and planted to rye in the fall of 1949. Treatments were made in the rye. Check plots showed an average count of 45.5 plants per sq. yd. August 17, 1950. Treated plots were compared to this average. No chemical at any rate showed a reasonable degree of control. Counts indicated no marked advantages for any one of the several formulations used. No advantage was shown for any rate of any one of the herbicides used. Results while only preliminary of these herbicides indicate little advantage in spring pre-emergence applications of these herbicides on leafy spurge. (Contri. by Agronomy Dept., S. Dak., Agri. Expt. Sta. and BPI, U.S.D.A.)

Effects of pre-emergence applications of herbicides on potatoes. Grigsby, B.H. Three varieties of potatoes in randomized replicated plots were planted on muck soil. The varieties used were, Chippewas, Sebago and Red Warba. Chemicals used and rates of applic. were as follows: 2,4-D, amine, 2 lbs./A, dinitro (Premerge) 4 lbs., PCP, Na salt, 12 lbs., ME 3003, 5 lbs., $PECX_3$, 5 lbs., EH #1, 2 lbs., EH #2, 5 lbs., xanthogen disulfide, 5 lbs. and TCA, 10 lbs. Emergence of potatoes was not reduced by any treatment. 2,4-D plots all showed leaf modification until the potatoes were 8-12" in height but later growth did not show this effect. Satisfactory weed control was obtained with dinitro, PCP, PEC and xanthogen disulfide. All other materials gave poor control of purslane and annual grasses. Yield of potatoes in all cases were equal to or greater than the untreated plots. (Michigan Agr. Exp. Station.)

Post cutting weed control in asparagus. Grigsby, B. H. Applic. of dinitro, PCP, Na salt, and dusting grade cyanamid were made to asparagus after discing at the end of the cutting season. The chief weeds in this field were lambsquarters, red-root pigweed and annual grasses. Dinitro at 4 lbs./A and PCP at 8 lbs. gave control of the broad-leaved weeds but did not kill the grasses. New seedlings of all types appeared within 10 days. Severe bending and malformation of asparagus developed within 48 hours after spraying. Dusting cyanamid, 75 lbs./A, applied as a spray gave perfect control of both grasses and broad-leaved weeds and did not cause any injury to the asparagus. A wetting agent was used in the spray suspension. (Michigan Agricultural Experiment Station.)

Pre-emergence use of herbicides on onions. Grigsby, B. H. Pre-emergence sprays of 2,4-D, amine, at 1 and 2 lbs., dinitro at 1 and 2 lbs., cyanate at 12 and 16 lbs., PCP (in oil) at 8 and 12 lbs., aromatic oil at 40 and 60 gallons, TCA at 8 and 12 lbs., xanthogen disulfide at 10 and 20 lbs., EH No. 1 at 2 and 3 lbs., EH No. 2 at 5 and 10 lbs., and PCP, Na salt, at 8 and 16 lbs. were applied to onions 6 days after seeding. Weed control ranged from 0 to 50% for all species of weeds. TCA gave 80% reduction in grasses but had no effect on broad-leaved species. Greatest total reduction of weeds was caused EH No. 1 and PCP, Na salt. Onion stands were reduced by all treatments but greatest effects were caused by the dinitro and PCP sprays. Least reduction was caused by cyanate, 2,4-D and EH No. 1. Yields were reduced by all treatments which caused more than 10% stand reduction. (Michigan Agricultural Experiment Station.)

The effect of TCA and two other chemicals plus fertilizer on quack grass (Agropyron repens) at Brookings, South Dakota, 1950. Kratochvil, D. E., James Hay, Lyle Derscheid and L. M. Stahler. Duplicate 12 foot by 60 foot plots were laid out in a well established quack grass sod on June 12, 1950 and treated with TCA, at 10, 20, and 40 pounds of acid per acre; 2,4-D in the micronized acid form at 4 and 8 pounds; 3, 6 endoxo hexahydrophthalic acid (E. C. 3002) at 8 and 16 pounds acid per acre, and IPC at 8 and 16 pounds per acre. The chemicals were mixed with enough ammonium nitrate fertilizer for an application of 100 lbs. of nitrogen per acre. This mixture was placed in a fertilizer attachment on a Ford tractor plow and plots were plowed about four inches deep. The fertilizer, plus the chemical, was placed on the plow sole. On July 15, 1950, an area 12 feet by 16 feet of each plot was surface treated with forty pounds per acre of TCA on all TCA plots, 8 pounds of 2,4-D on all 2,4-D plots, 16# of E.C. 3002 on all E.C. 3002 plots and 16 pounds of IPC on all IPC plots. Estimations of percent control were taken September 15, 1950. TCA at 40 pounds plus fertilizer with no surface treatment gave 35% control, at 20 pounds - 20 percent, and 10 pounds - 16 percent. TCA at the rate of 40 pounds below plus 40 pounds above gave 90 percent control; 20 pounds below plus 40 pounds above gave 90%; 10 pounds below plus 40 above gave 3.1 percent elimination. Little rain was received on the plots after the initial treatment until late fall. (Contributed by the Agronomy Department of the South Dakota Expt. Station and the Bureau of Plant Industry Soils and Agricultural Engineering, U.S.D.A.)

Pre-emergence sprays on direct seeded tomatoes. Lana, E. P. The materials used and rates per acre applied 5 days before general emergence were Stanisol, 80 gals., Na salt PCP at 10, 5 and 2½ lbs., Na salt of 2,4-D 1 lb. acid equivalent, 2,4-D amine 1 lb. acid equivalent, low volatile ester of 2,4-D, 1 lb. acid equivalent, Dow General (DNOSBP) 3 pts. and 24 pts. oil per 100 gal. H_2O, E.H.-1 1 lb., Dow Premerge (DNOSBP, amine salt) 2 lbs., 90 per cent TCA 5 lbs., Dow Selective (DNOSBP, ammonium salt) 2 gal. and Acetanalide 1 lb. in #2 fuel oil per 100 gal. H_2O. Weed control was spotty due in part to the excessive moisture following the herbicidal applications. The mean temperature for the season following spray applications was about 8 degrees below normal. There was a significant difference in weed stand based on the number of days to cultivation over the control in the plots treated with 10 lbs. PCP, Na salt 2,4-D, Premerge and TCA. The difference between the control and 2,4-D amine, the low volatile ester and Acetanalide was highly significant. TCA and Premerge are apparently leached under high moisture conditions after treatment since plots that were partially water covered gave weed control no better than the untreated plots. Stand was significantly less at the one per cent level three weeks after general emergence for all treatments except Stanisol, TCA, Na PCP 2½ lb., Na PCP 5 lbs. and Dow Selective. Premerge practically eliminated the tomato plants while Na PCP 10 lbs. cut stands 75 per cent. Stunting was observed on plants of the plots that received Na PCP 10 lbs., Na salt 2,4-D, 2,4-D amine, low volatile ester, Premerge and Acetanalide. No yields were taken because of the lateness in fruit ripening. (Iowa Agr. Exp. Sta., Ames, Iowa.)

Lima and snap bean pre-emergence study. Lana, E. P. Three pre-emergence treatments were applied within 24 hours of planting; Na salt PCP 15 lb., Dow Premerge (DNOSBP, amine salt) 1 lb. and 2,4-D amine 1 lb. acid equivalent per acre. A post-emergence spray of E.H.-1 at 1 lb. per acre was applied after the control was cultivated to test the reaction of this herbicide on plant growth and yield. There were no significant differences in plant stand for the pre-emergence treatments when compared with the untreated for both lima and snap beans. On the lima beans the days to cultivation was significantly higher for the amine treatment with no significant differences found for PCP and Premerge. The days to cultivation for the snap beans was highly significant for all three pre-emergence treatments. There were no significant differences in yield on the pre-emergence treatments for both types of beans. EH-1 as a post-emergence spray caused some leaf curviture and delay in blossoming, but the reduction in yield compared with the control was not significant for either lima or snap beans. (Iowa Agr. Exp. Sta., Ames, Iowa.)

Tolerance of tomatoes to maleic hydrazide. Lana, E. P. Preliminary greenhouse studies indicated that growth of tomato plants could be retarded by the use of various concentrations of maleic hydrazide. Inhibition was increased with increase in concentration. 2000 P.P.M. was not fatal but main stem and lateral growth was almost completely inhibited. Field studies with applications of 250, 500, 1000 and 2000 p.p.m. gave similar results. However, recovery at 2000 p.p.m. was more evident. The effect of pruning by removing the main stem appeared more effective in stimulating lateral growth than MH applications. There was a highly significant increase in length of the main stem of the untreated over the four applications, with the least growth on the heaviest application. One month after application there were no significant differences between the control the pruned plants in total vine length. The MH plants showed a highly significant growth retardation. Number of laterals produced on 250 and 500 p.p.m. plant showed no decrease while the number on the 1000 p.p.m. and pruned were highly significantly less. The 2000 p.p.m. had no laterals at this time. Yields taken up to frost showed a highly significant decrease in yields between the control and MH treatments with the decrease directly with the increase in strength. 2000 p.p.m. produced no ripe fruits. There was no significant difference in yield between the control and pruned treatment. Pruning delayed harvesting two weeks but the amount of fruit harvested on the first pruned picking equaled the yield of the 1st three harvests of the control. 250, 500, and 1000 p.p.m. harvests were delayed three weeks. (Contr. by Iowa Agr. Exp. Sta., Ames, Iowa.)

Effect of pre-emergence treatments on corn. Lee, Oliver C. and Oyer, E. B. Replicated plots were sprayed to determine tolerance of corn. Five materials were used: isopropyl ester of 2,4-D in rates of 2, 3 and 4 pounds of 2,4-D acid per acre; polypropylene glycol butyl ether ester, rates 1, 2 and 3 pounds per acre; 3,6-endoxohexahydrothalic acid (disodium salt), rates 2 and 4 pounds per acre; sodium 2,4-dichlorophenoxy ethyl sulfate, rates 2, 4 and 8 pounds per acre; and dichloral urea, rates 2, 4 and 8 lbs.

per acre. Corn was planted on June 1, and sprays were applied June 6. First emergence of corn occurred on June 7. The soil, a Brookston silt loam, was moist to wet at time of treating and for several days following. Temperature ranged in the low 80's making conditions favorable for corn growth. Treatments of 1 pound of polypropylene glycol butyl ether ester did not effect the corn. Two pounds caused slight dwarfing and slight reduction in stand, while corn showed considerable injury from 3 pounds. Similar results were obtained with 3 and 4 pound treatments of isopropyl ester. No effects were observed from treatments of 3,6-endoxohexahydrothalic acid. Sodium 2,4-dichlorophenoxy ethyl sulfate and dichloral urea showed promise of controlling grassy weeds. All rates of these materials caused curling of corn leaves, and in the case of the 4 and 8 pound rates produced stunting of plants and reduced stands. (Contribution of Agricultural Exp. Station, Purdue University)

Effect of TCA and maleic hydrazide on quack grass (Agropyrons repens) Lee, Oliver C., and Oyer, E. B. Replicated plots, one half sq. rd. in size, were staked out in a clover-timothy field which was heavily infested with quack grass. The soil (a sandy loam) was at a medium moisture level at the time of the first treatment on June 27. Since the quack grass was 3-4 feet high at this time, and many plants had already formed seedheads, the area was clipped before the chemicals were applied in order to insure more uniform coverage. Both chemicals were diluted with water and applied at the rate of 160 gal./A. TCA was applied at 30, 60 and 90 lbs. of the pure sodium salt per acre, and maleic hydrazide was applied at 8, 12 and 30 lbs. of the active ingredient per acre. One set of plots was clipped and another series cultivated four times during the summer. All rates of TCA gave excellent control of quack (95-100 per cent kill) until October 10 when some regrowth from crowns and rhizomes was noted. Proportionally more regrowth appeared on plots treated with 30 lbs./A. than on plots receiving 60 and 90 lbs./A. Live rhizomes were found under all plots. Maleic hydrazide gave no control at 8 lbs./A., it reduced stand of quack by approximately 1/4 at 12 lbs., and 3/4 at 30 lbs./A. Growth of plants treated with 30 lbs. maleic hydrazide was severely inhibited. On August 8 the plots receiving 8 and 12 lbs. maleic hydrazide per acre were retreated. This time the herbicide was applied directly to the foliage which was about 1 foot in height. This second application gave no better results than the first spraying. Live rhizomes remained under all treated plots. On August 25 half of the cultivated plots were sprayed with TCA at 20 lbs./A. following the cultivation. By October 10 there was no regrowth on this half of plots. Observations will be made next spring to determine the amount of rhizome kill secured by all treatments. (Contrib. of Agricultural Experiment Station, Purdue University.)

Effect of pre-emergence treatments on soybeans. Lee, Oliver C. and Oyer, E. B. Pre-emergence treatment on Lincoln soybeans was made on June 10, five days after the beans were planted. At this time, 50 per cent of the plants had emerged to the cotyledon stage. Chemicals used included: (a) isopropyl ester of 2,4-D at 1.5, 2, and 2.5 lbs./A.; (b) polypropylene glycol butyl ether ester of 2,4-D at 1, 1.5 and 2 lbs/A.; (c) 3,6-endoxo-

hexahydrothalic acid (formerly E.C. 3740) at 2 and 4 lbs/A.; (d) dinitro-o-sec butylphenol at 4, 6 and 8 lbs./A.: and (e) polychloro aryl alkyl carbonate (Goodrite 3947) at 4 gal./A. Water was used as a diluent, and the solution was applied at the rate of 12 gal./A. Plots were replicated four times. The Brookston silt loam in which the beans were growing was very moist at time of treatment. Moist soil conditions prevailed after the treatment as measurable precipitation was recorded for 8 of the 9 days immediately following the day of treatment. Visual observations were made on June 28 when beans were 4-6 inches high. All rates and formulations of 2,4-D caused some stand reduction, dwarfing of plants, and distorting of stems and leaves. No harmful effects to the plants were noticed at the 2 lb./A. rate of 3,6-endoxohexahydrothalic acid; slight cotyledon burn was the only injury observed at the 4 lb. rate. The DNOSBP had no markedly harmful effects on the plants at the 4 lb. rate and only slight injury in the form of distortion of leaves and stems at 6 lbs. The 8 lb. rate caused stand reduction and dwarfing of plants. The Goodrite 3947 gave injury symptoms similar to 2,4-D. Observations made on September 15 when control plants were nearing maturity showed that plants treated with both formulations of 2,4-D at all rates were retarded in their maturity, and plants treated at high rates were dwarfed. All plants treated with 3,6-endoxyhexahydrothalic acid appeared normal. Slight dwarfing and delayed maturity was evident on plants treated with DNOSBP at 8 lbs/A., while 4 and 6 lb. treatments apparently had no lasting effect on beans. Plants treated with Goodrite 3947 appeared normal. Area was not sufficiently weedy to give check on weed control. No yield checks were made. (Contribution of Agricultural Experiment Station, Purdue University.)

Effect of materials applied as defoliants in soybeans. Lee, Oliver C. Several materials having shown promise for use as defoliants in soybeans were applied to plots of weedy soybeans. One series of plots was sprayed with ground equipment, the other by airplane. The materials used included pentachlorophenol in fuel oil and a special oil, Dinitro, in fuel oil, aero cynate, and a sodium chlorate and borax mixture in water. All the materials applied caused burning of foliage of both soybeans and weeds, including grasses. The materials had very little effect on the heavy stems of such weeds as jimson, horseweed and pigweed. There appeared to be very little difference between the results obtained from dinitro and pentachlorophenol in oil. Rates of 2, 4 and 6 gallons of spray per acre applied indicates that the maximum dosage is needed to assure adequate coverage to produce the desired results. This is particularly true in fields heavily infested with weeds. When sprays were applied approximately three weeks before normal maturity or when soybeans were still green in the pod, considerable discoloration and shriveling of beans occurred. This did not occur when sprays were applied later when beans were firm in the pod at the time of spraying. (Contribution of Agricultural Experiment Station, Purdue University.)

Application of potassium cyanate and maleic hydrazide to flax at three locations in the Dakotas and Minnesota in 1950. MacDonald, W.P.; Zinter, C.C.; Slough, A.T. 91% potassium cyanate was applied at 5 and 10 lbs. per acre with 10 gals. of water. 30% maleic hydrazide was applied at 2, 4, 6, 8, and 12 lbs. per acre with 10 gals. of water. At the three locations, flax ranged in height from 1 to 6 inches. Setaria, common mustard, wild buckwheat, lambs quarter, pigweed, annual sunflowers, and several other broad-leaved weeds ranged in height from emergence to 5 inches. At no time was the flax damaged by potassium cyanate and control of both broad-leaved and narrow-leaved weeds was unsatisfactory. On the maleic hydrazide plots growth of both flax and weeds was almost completely arrested up to the time when the untreated checks were nearly ready for harvest. At that time it appeared that all growth resumed with the flax ready for harvest approximately 3 weeks late and otherwise not unduly affected by the treatment. (Contribution of Agr. Dept., F. H. Peavey & Co., Minneapolis, Minn.)

The response of Johnson grass to chemicals applied to the soil during winter months. McCall, G. L., D. W. Rake and J. W. Zahnley. An area of ground solidly infested with Johnson grass, the tops of which had been killed by frost was chemically treated on November 7, 1949. The infested area was on creek bottom land of a light sandy loam texture. Treatments used were Polyborchlorate at 480, 640, 800, and 960 pounds per acre, Trichloroacetic acid as the sodium and calcium salts at 50, 100 and 200 pounds per acre and Carbide and Carbon E.H. #2 at 100 pounds per acre. Additional treatments were applied on January 1, 1950 using Polyborchlorate at 480 pounds per acre and trichloroacetic acid as the sodium and calcium salts at 100 pounds per acre. Corn, Atlas sorghum, soybeans and sweetclover were planted in all plots the first week in June in order to determine the amount of residual toxicity in the treated areas. Data indicates that the rhizomes of established plants treated during the winter were killed by dosages of 800 pounds per acre of Polyborchlorate, by 50 pounds per acre of trichloroacetic acid as the sodium or calcium salt, and by 100 pounds per acre of E.H. #2. In general the Polyborchlorate at 800 pounds per acre was more effective for preventing the establishment of seedlings than were E.H. #2 at 100 pounds per acre or TCA at 50 pounds per acre, but by the same token was more toxic to the crop plants than were the TCA and E.H. #2. Sweetclover and soybeans planted in June following the treatments were killed by all dosages of all chemicals. Corn was somewhat more resistant with at least a few plants growing in each plot. Without exception Atlas sorghum was the most resistant to residual toxicity of all the crops used in these tests. Its growth was near normal in plots treated with 100 pounds per acre of E.H. #2 or 100 pounds per acre of TCA. (Contributed by the Kansas Agricultural Experiment Station, Manhattan, Kansas.)

A field study on evaluation of herbicides for Canada Thistle (Cirsium arvense). Miller, J. H., Hoggeness, H. G., and Dunham, R.S. Fifteen selected herbicides were applied at rates of 1.5 and 3 pounds of acid equivalent per acre. Duplicate applications were made on 2 square rod plots at the "shooting stage" of the Canada thistle. Forty gallons of solution were applied per acre. The

herbicides included: maleic hydrazide, disodium 3,6-endoxyhexahydrophthalate; five 2,4-D formulations, three of which were low volatile esters, one amine salt, and one emulsified acid; three 2,4,5-T formulations of which two were esters and one an amine salt; two 2,4-D and 2,4,5-T mixtures, one an ester and one an emulsified acid; three MCP formulations, an ester, an amine salt, and a sodium salt. Top growth was killed by nearly all the herbicides, however, fall regrowth appeared in varying degrees on all plots. Fall observations indicate two low volatile esters of 2,4-D; one ester of 2,4,5-T; and an amine salt of MCP to be considerably more promising than the standard used (butoxy ethanol ester of 2,4-D and 2,4,5-T). An emulsified acid of 2,4-D; an amine of 2,4-D; an amine salt of 2,4,5-T; and a mixture of 2,4-D and 2,4,5-T as emulsified acids appeared about equal to the standard. The remaining six herbicides appeared to have little promise for Canada thistle control. The three pound rate appeared somewhat more promising than the 1.5 pound rate. (A joint contribution of the U.S.D.A.; Minnesota Agricultural Exp. Station: and Minnesota State Dept. of Agriculture.)

A study on the chemical control of weeds in onions by pre-emergence treatments. Nylund, R.E. On May 18 muck soil which had been prepared on May 11 was seeded to Brigham Yellow Globe onions. On the seventh day after seeding the following twenty pre-emergence treatments were applied to plots replicated five times: potassium cyanate at 12, 16, and 20 lbs. per acre; Esso #45, Stoddard solvent, and Amsco D oils at 40 and 80 gal. per acre; Xanthogen disulphide at 10 and 20 lbs.; sodium isopropyl xanthate at 15 lbs.; sodium trichlorophenate at 10 and 15 lbs.; sodium tetrachlorophenate and sodium o-phenylphenate at 7.5 and 10 lbs.; and E.H. #1 (sodium 2,4-dichlorophenylphenate) at 2 and 4 lbs. Air temperature at the time of spraying was 60° F., humidity 58%, and the soil was moist. All of the treatments with the exception of E.H. #1 significantly reduced weed populations. However, Xanthogen disulphide at 10 and 20 lbs., sodium isopropyl xanthate, sodium tetrachlorophenate at 10 lbs., and sodium orthophenylphenate at 7.5 lbs. significantly reduced stands and yields of onions. Treatments which gave 90%-100% weed control without reducing onion stand and yields were: potassium cyanate, Esso #45, and Amsco D at all rates used; and sodium trichlorophenate at 15 lbs. per acre. Other treatments gave weed control ranging from 64 to 86%. (Paper No. 714 of the Miscellaneous Journal series of the Minnesota Agricultural Experiment Station.)

A study on the toxicity of potassium cyanate to onions as influenced by date of planting, stage of growth, and rate of application. Nylund, R. E. Brigham Yellow Globe onions were seeded on muck soil on May 25, June 5, and June 15. Potassium cyanate at rates of 8, 12, and 16 lbs. per acre (in 80 gallons water) was applied to plots in each of these seedings when onions had reached the crook stage, late first-leaf stage and early third-leaf stage. Sprays were applied at 50-60 lbs. pressure directly over the onion row using a knapsack sprayer fitted with a flat-fan nozzle. All plots were hand-weeded to eliminate weed competition. Observational notes on growth as well as stand counts and yield data showed that potassium cyanate at the rates used had no toxic

effect on the onion plants irregardless of the stage of growth at the time of application. These results differ from results obtained in a previous year when 16 lbs. of potassium cyanate caused serious damage to onions. The fact that all through the period of spraying in 1950 (June 7-July 29) temperatures and precipitation were below normal may explain the differences in results obtained. In the previous year the temperature was somewhat higher and the soil moisture content was considerably higher which would tend to make the plants more succulent and thus more susceptible to chemical action. (Paper No. 713 of the Miscellaneous Journal Series of the Minnesota Agricultural Experiment Station.)

A study on the effects of 2,4-D and MCP on yields and tuber color of Pontiac potatoes. Nylund, R. E. Pontiac potatoes planted on May 15 on muck soil were sprayed with 2,4-D (alkanolamine salt) and MCP (amine salt) at ¼, ½, and 1 lb. per acre at four stages of growth: (1) when plants were 6-8" tall (June 12), (2) when plants were 12-18" tall (June 26), (3) when plants were in bud stage (July 10), and (4) at end of flowering period (Aug. 21). All sprays were applied with a knapsack sprayer at approximately 50 lbs. pressure and 40 gal. water per acre. All 2,4-D and MCP treatments tended to reduce yields of U. S. #1 tubers with the 2,4-D treatments causing the greatest reductions. 2,4-D at ½ or 1 lb. per acre when applied to plants 6-8" tall, all three 2,4-D treatments when applied to plants 12-18" tall or in the early bud stage, and 1 lb. of 2,4-D when applied to plants at the end of the blossoming period significantly reduced yields. Only one of the MCP treatments (½ lb. applied to plants 12-18" tall) significantly reduced yields; however, all of the other MCP treatments tended to reduce yields. Field notes on tuber color taken at time of harvest indicate that, in a general way, those treatments that most seriously reduced yields caused the greatest intensification of red periderm color. 2,4-D at ½ and 1 lb. when applied to plants 12-18" tall and 2,4-D at all rates when applied to plants in the bud stage significantly intensified tuber periderm color. Also, MCP applied at ½ and 1 lb. to plants in the bud stage significantly intensified periderm color. Laboratory studies on the effects of the 2,4-D and MCP treatments on dry matter content, on Vitamin C content, and on anthocyanin content are being conducted. (Paper No. 726 of the Miscellaneous Journal Series of the Minnesota Agricultural Exp. Sta.)

A study on the post-emergence application of herbicides to onions. Nylund, R. E. Brigham Yellow Globe onions, seeded on muck soil on May 15, were sprayed with the following herbicides on June 14 when the onion plants were in the one-leaf stage: potassium cyanate at 8, 12, and 16 lbs. per acre, Stoddard solvent at 80 gal. per acre, Xanthogen disulphide at 10 and 20 lbs. per acre, sodium trichlorophenate and sodium tetrachlorophenate at 15 and 20 lbs. per acre, and E.H. #5722 at 1 and 2 lbs. per acre. Most of these herbicides were applied both over the row (unshielded) and along both sides of the row protecting the tops of the onion plants by using a shield on the sprayer (shielded). The only treatment which significantly reduced weed population without reducing yields of onions when applied over the top of the row was potassium cyanate at 8 lbs. per acre which killed 56% of the weeds present.

Six of the "shielded" treatments gave significant weed control without reducing yields: Potassium cyanate at 12 lbs. and at 16 lbs., Xanthogen disulphide at 10 lbs., sodium trichlorophenate at 20 lbs., and sodium tetrachlorophenate at 15 and 20 lbs. Percentages of weeds killed by these six treatments were 62, 77, 55, 78, 51, and 66, respectively. Principal weed species present were (in descending order of number present): Capsella bursa-pastoris, Amaranthus retroflexus, Polygonum persicaria, Setaria glauca, Portulaca oleracea, and Chenopodium album. (Paper No. 724 of the Miscellaneous Journal Series of the Minnesota Agr. Expt. Station.)

A study on the value of herbicides for the control of crabgrass in turf. Nylund, R. E. Bluegrass turf, having a dense stand of crabgrass, was sprayed with 11 herbicides starting on July 13 when the crabgrass had 2 to 4 leaves. Each of the following treatments was applied to four 10' x 10' plots: L-2988 (Standard Crabgrass Killer), L-2687, and Stoddard Solvent at 80 gallons per acre; Kerosene at 120 gal. per acre; E.H. #2 (dichloral urea) at 5 lbs. in 80 gal. water per acre; Potassium cyanate (Weedone Crabgrass Killer) at 7.4 lbs. in 305 gal. water; S-1980 and S-1998 at 18.75 lbs. in 360 gal. water; TCA (Na salt) at 10 lbs. in 80 gal. water; Maleic hydrazide at 0.3% solution at 160 gal. per acre; and phenyl mercuric acetate (Tat-C-Lect) at 0.79 lbs. in 87 gal. water. The rates indicated above refer to quantity of active ingredient applied. The commercially available herbicides were applied according to manufacturers' directions. S-1980 and S-1998 were reapplied 4 and 8 days after the initial application; kerosene and Tat-C-Lect reapplied in 7 days; and L-2988, L-2687, E.H. #2, and potassium cyanate were reapplied after 10 days. The other treatments were applied only once. For all applications the soil was moist, air temperature ranged from 65°-75°F., and grass was clipped at 1½". Sprays were applied with a knapsack or Sure-Shot sprayer operated at 50 lbs. pressure. Only Tat-C-Lect, S-1998, and Stoddard Solvent gave 100% control of crabgrass. The Tat-C-Lect caused no injury to the bluegrass, S-1998 only slightly retarded growth of the bluegrass, while Stoddard Solvent killed the bluegrass wherver the spray had overlapped. Of the remaining herbicides potassium cyanate gave fair control (80%) of the crabgrass without injury to the bluegrass, while the other herbicides tried either gave no crabgrass control or slight control accompanied by equally severe damage to the bluegrass. (Paper No. 725 of the Miscellaneous Journal Series of the Minnesota Agricultural Experiment Sta.)

Response of crab grass (Digitaria spp.) and turf to herbicides. Over, E. B. Four materials were applied to replicated plots located on an established golf course turf heavily infested with crab grass. The principle turf grasses were Kentucky blue grass and Canada blue grass. Treatments included potassium cynate, rates of 8 and 12 pounds per acre; phenyl mercury acetate, rates 10 and 15 ounces per acre; sodium trichloroacetate, rates 6, 8 and 12 pounds per acre; and maleic hydrazide, rates of 2, 4 and 8 pounds per acre. All treatments were applied in water at the rate of 200 gallons per acre. First applications were made when crab grass was in the two leaf stage of growth. Two applications of potassium cynate made at ten day intervals killed 90 per cent of the crab grass. The 12 pound rate caused considerable browning of the turf

grass while the effect of the 8 pound rate was not pronounced. The turf recovered rapidly and developed a dark green color as compared to checks. After an interval of 30 days, plots were retreated to check the growth of new seedlings appearing in later summer and early fall. Six applications of phenyl mercury acetate applied at 10 day intervals reduced the stand of crab grass, but control was not satisfactory. This material did not injure the turf grasses. Sodium trichloroacetate at rates applied destroyed all grasses. Three applications of maleic hydrazide at rates of 4 pounds caused dwarfing and slight injury to turf grasses as well as crab grass. The 8 pound rate produced some injury to all grasses. Rates tolerated by the turf grasses did not give satisfactory control of crab grass. A preliminary experiment was conducted to determine the possibility of controlling crab grass in bent grass turfs. Ten varieties of bent grass were sprayed with the four materials mentioned. Bent grass apparently will tolerate the use of potassium cynate applied in sufficient quantity to destroy crab grass. (Contribution of Agr. Exp. Station, Purdue University.)

Effect of maleic hydrazide on Johnson grass (Sorghum halapensis), Quack grass (Agropyrons repens), and Crab grass (Digitaria spp.). Oyer, E. B. The chemical was applied in a water solution in all cases without addition of a wetting agent. When used in treatment for S. halapensis and A. repens, the spray solution was applied at the rate of 160 gal./A. In case of treatment of Digitaria spp., the rate was 200 gal./A. All plots were replicated. In general, results obtained were not favorable. Plots heavily infested with S. halapensis were clipped before treatment. The chemical was applied at 8, 12 and 30 lbs. of active ingredient per acre. More encouraging results were obtained on another series of plots sprayed two weeks later after grass had made some regrowth. No lasting effects were noted at any rate when chemical was applied to stubble. However, the second spraying gave complete kill of top growth at 30 lbs./A. Growth was inhibited and slight stand reduction was noted at the 8 and 12 lb. rates. No complete kill was obtained at these rates. A greater difference was noted between the 8 and 12 lb. rates when the chemical was applied to clipped plots of Agropyron repens. The chemical gave no control at 8 lbs., reduced the stand by about 1/4 at 12 lbs., and by approximately 3/4 at 30 lbs./A. The surviving grass on 8 and 12 lb. plots was retreated at the same rate after some regrowth was made. Very little noticeable effect of chemical on the grass was observed. Some killing of leaves occurred but no complete killing of plants. The chemical was applied to both blue grass and bent grass turf which was infested with Digitaria spp. Rates used on lawn turf were 2, 4, and 8 lbs./A. Three treatments were made on each plot. The 2 lb/A. rate was the only rate at which turf injury was not pronounced, and crab was only slightly discolored but not killed. Turf burn was moderate to severe at the 4 lb. rate and severe at the 8 lb. rate. When applied to bent grass, one treatment was made at 2 and 3 lbs./A. No effect on either crab or bent was noticeable 10 days after spraying. A second application was made at 4 and 6 lbs./A. Bent showed severe damage 13 days after this treatment. The bent did not recover, and plots sprayed with maleic hydrazide were practically void of bent grass at the end of the season. The

crab grass in the bent grass plots was not controlled. (Contribution of Agricultural Experiment Station, Purdue University.)

Effects of 2,4-D and MCP on Weed-free Nemaha Oats. Shafer, N. E. Hand weeded plots of Nemaha oats were treated at four stages of growth: jointing, early boot, late boot, and flowering. Isopropyl ester at 1/4 # and 1/2 #; butoxy ethanol ester at 1/4 #, 1/2 #, and 1 #; amine salt at 1/2 # and 1 # and amine MCP (2 methyl, 4 chlorophenoxyacetic acid) at 1/2 # and 1 # per acre were applied on all stages of growth. Treatments put on at the jointing stage caused the most injury. All rates of all chemicals gave highly significant reductions in yield when applied at the jointing stage except MCP at 1/2 # and 1 # and amine salt at 1/2 #. Butoxy ethanol ester at 1 # caused a significant reduction in yield when applied at the early boot stage. No other significant reductions were caused in that stage by the other materials used. Treatments made when the oats was in the late boot and also when flowering caused no significant reductions in yields by any rates of chemicals used. The average yield obtained from all four stages of growth showed the isopropyl and butoxy ether esters at all rates and the amine salt at 1 # caused highly significant reductions in yield. Reductions in yield were the direct result of increased floret sterility and reduction in number of florets. Germination was not affected by any of the treatments. (Contri. of the Dept. of Agronomy, Nebraska Agr. Exp. Station, Lincoln, Nebraska.)

Toxicity of five chemicals applied as soil treatments. Shafer, N. E. and D. W. Finnerty. Five chemicals were applied at three rates each to flats in a greenhouse containing 100 germinating seeds of each of the following grasses: crabgrass, downy bromegrass, yellow foxtail, and hairy chess. Chemicals were applied in water at 40 gpa. Materials and rates were: IPC, 3, 6, and 9 pounds per acre; E.H.#1, 2, 4, and 8 pounds; E.H.#2, 4, 8, and 12 pounds; 2,4-D amine salt, 2, 4, and 6 pounds; and Dow Premerge, 3, 6, and 12 quarts per acre. Compared to untreated flats seedling survival counts taken two weeks following applications showed that all treatments except E.H.#1 and #2 gave 78% control or better, with the exception of 2,4-D amine salt on downy bromegrass, which gave only 59% control at 6 pounds per acre. Dow Premerge at 6 and 12 quarts per acre and IPC at 6 and 9 pounds per acre gave kills approaching 100% on all four grasses. (Contri. by Nebraska Agricultural Experiment Station.)

Pre-emergence weed control in soybeans. Slife, F. W., G. E. McKibben, and R. F. Fuelleman. Duplicate plots of Hawkeye soybeans were sprayed just prior to emergence with IPC at 8 and 16 pounds per acre, 2,4-D amine one and two pounds per acre, Dow Premerge 12 quarts per acre, ACP 638 one and two pounds per acre, ACP 648 one and two pounds per acre, 3003 at 4 pounds per acre, and maleic hydrazide at 8 pounds per acre. IPC, maleic hydrazide, and 3003 had no effect on the beans and were not effective as a pre-emergence treatment. ACP 648, ACP 638, and 2,4-D at 2 pounds per acre gave excellent weed control but reduced the emergence of the beans slightly. The beans on these plots were less vigorous in the early stages of growth than were the beans on the check plots.

ACP 648, ACP 638, and 2,4-D at 1 pound per acre gave good weed control for 4 weeks but reduced the vigor of the soybeans slightly. 2,4-D seemed less injurious to the soybeans than ACP 648 or ACP 638. Dow Premerge gave excellent weed control, but at 12 quarts per severely reduced the emergence of the soybeans. The soil was a brown silt loam. (Contribution of the Illinois Agricultural Exp. Station, Urbana, Illinois.)

Chemicals for pre-emergence weed control in corn. Slife, F. W. and R. F. Fuelleman. The following chemicals were applied as a pre-emergence spray to corn, 2,4-D amine one and two pounds acid per acre, MCP amine one and two pounds acid per acre, ACP 648 one and two pounds acid per acre, ACP 638 one and two pounds acid per acre, ACP 646A two pounds per acre, EH 1 four and eight pounds per acre, Dow Premerge 12 quarts per acre, and 3003 four pounds per acre. These chemicals were applied 2 days after planting. This was followed by a small shower which fell the third day after planting. The soil was a black silt loam. Corn emerged on all plots after 6 days without injury except on the Premerge plots which had reduced germination. 3003 did not prevent the emergence of grass or broadleaf weeds and these plots were not distinguishable from the uncultivated checks. 2,4-D, MCP, ACP 648, and ACP 638 at 1 pound per acre and ACP 646A gave good weed control all season except for a few grass weeds emerging later in the season on all these treatments. 2,4-D, MCP, ACP 648, and ACP 638 at 2 pounds per acre gave excellent weed control during the entire season, with the ACP 638 and 2,4-D giving the best results. EH 1 gave excellent results at both 4 and 8 pounds per acre, and these treatments were as effective as the 2 pound rates of 2,4-D and ACP 638. Dow Premerge gave good weed control, but reduced the germination of the corn. (Contribution of the Illinois Agricultural Exp. Station, Urbana, Illinois.)

The effect of certain weed chemicals on Ladino clover. Slife, F. W. and R. F. Fuelleman. MCP, 2,4-D, TCA, and IPC were applied to second year Ladino clover on May 25, August 15, and October 10. Each series of treatments were mowed every 15 days prior to treatment to simulate grazing. The amine formulation of both MCP and 2,4-D was applied at 1/4, 1/2, 1, and 2 pounds of acid per acre. It would appear from these preliminary tests that Ladino is rather resistant to 2,4-D. It was not affected by 1/4 pound applications; 1/2 pound caused twisting and curling of the stems but it recovered completely within 2 weeks, 1 pound caused severe twisting of the top growth but no reduction in stand and it appeared normal within 1 month, and 2 pounds caused severe twisting of the stems, some dying of the leaves, and a slight reduction in stand of plants. Plots receiving 2 pounds of 2,4-D, although severely stunted for 2 months, began to grow after that time and new plants from the stolons soon covered the entire plots. By late fall these plots could not be distinquished from the check areas. MCP was similar to 2,4-D in its mode of action on Ladino but was much more severe. In general MCP seemed to be about twice as effective as 2,4-D on Ladino in that 1/4 pound produced the same effects as 1/2 pound of 2,4-D, etc. MCP at 2 pounds eliminated 90 percent of the Ladino and in late Sept-

ember there was little or no regrowth on these plots. TCA had no effect on Ladino at 5 pounds per acre but 10 pounds caused a slight burning on the edge of the leaves. IPC with an oil base caused no injury to Ladino at 8 pounds per acre, but 16 pounds per acre caused severe burning of the leaves due to the oil carrier. (Contribution of the Illinois Agricultural Exp. Sta., Urbana, Illinois.)

Screening test rating of herbicidal chemicals applied as preemergence treatments on several crops and weeds. Brookings, S. D., 1950. L. M. Stahler, James Hay, D. E. Kratochvil, L. A. Derscheid. Endothal, E.C. 3890 (Sharples); E.H. 5722, E.H. 2, (Carbide & Carbon); IPC (Am. Chem. Paint); Sulfasan (Monsanto); Cyanate (Am. Cyanamid); maleic hydrazide (Naugatuck); Premerge (Dow); ACP-646 (Am. Chem. Paint); Dow H-1010, Dow A-548 and an amine of 2,4-D; Linck MIX (Linck) were applied to sugar beets in rows 48 hours before the emergence of beet and weed seedlings at rates determined earlier in greenhouse tests. Endothal at 2, 4, or 6 pounds per acre gave a high degree of control of grass seedlings with no measurable effect on beets, peas, soybeans and sunflowers; practically eliminated flax and severely injured stand and vigor of corn and oats. IPC at rates of 4, 8 or 16 pounds; surface applied or disced, gave no satisfactory weed control and seriously injured flax, peas, oats, and corn at higher rates--being more destructive where disced in. E.H. 2 gave moderate control of grasses, injured only soybeans and sunflowers. Sulfasan at 10 or 15 gallons sharply reduced stands of flax and oats, no effect on other crops, no measurable weed control. Cyanate at 10 or 15 pounds showed no effect on either crops or weeds. Premerge at 3, 6 or 9 qts. eliminated beets, injured flax, gave no satisfactory weed control. Maleic hydrazide at 8 or 16 pounds showed some effects on all crops at the higher rates with no economic weed control. Of the 2,4-D formulations the acetanalide at 1 or 2 pounds per acre markedly affected only beets; gave fair control of broad-leaved and annual grasses. Other 2,4-D formulations at equal rates markedly affected beets, peas and sunflowers but gave equal or better weed control. Linck MIX affected only beets with no visible effect on other crops or weeds. E.C. 3890 at 3 or 6 pounds per acre gave fair control of grass weed seedlings with measurable affect on only oats, soybeans and corn. (Contribution of Agronomy Dept., South Dakota State College, & Bureau of Plant Industry, Soils & Agricultural Engineering, U.S.D.A.)

Screening test rating of herbicidal chemicals applied as postemergence treatments on several crops and weeds. Brookings, S. D., 1950. Stahler, L. M., James Hay, D. E. Kratochvil, L. A. Derscheid. Endothal, E.C. 3890, M.E. 3001, (Sharples); E.H. 5722, E.H. 2, E.H. 5678, E.H. 5669, E.H. 568, E.H. MIX (C. & C.), E.H. 5665, maleic hydrazide (Naugatuck); Dow A-548, Dow H-1010; and an amine of 2,4-D were applied at rates previously determined by greenhouse tests to sugar beets, canning peas, flax, oats, soybeans, corn and sunflowers when the crops were 2 to 6 inches high and grass and broad leaved weed seedlings were well established. Tolerance rating factors determined on crops indicated that beets, peas, corn and sunflowers were fairly tolerant to Endothal at rates of 1 or 2 pounds per acre; only sunflowers tolerant to 4 or 6 pounds per acre. A

A fair degree of grass weed control was secured with 2 to 6 pounds per acre of this material; no broad leaved weed control. Flax, oats and soybeans were markedly susceptible to all rates of Endothal. M.E. 3001, a formulation of Endothal, showed a similar reaction. Of the Carbide & Carbon products only E.C. 3890 and E.H. 5669 showed a marked degree of grass weed control with measurable injury on only soybeans. Maleic hydrazide at 4 or 8 pounds eliminated sugar beets and markedly reduced growth vigor of all other crops; likewise reduced growth vigor of both grass and broad leaved weed seedlings. All crops showed a higher degree of tolerance to Dow A-548 than to the two 2,4-D formulations; peas, flax, oats and corn showing no reaction from ¼ or ½ pound of the 2, methyl-4-chlorophenoxy-acetate. Several of the materials showing a high degree of crop tolerance plus definite control of either broad leaved or annual grass weeds indicated above should be further investigated. (Contribution by Agronomy Dept., South Dakota State College, & Bureau of Plant Industry, Soils & Agricultural Engineering, U.S.D.A.)

Effect of maleic hydrazide as a pre- or a post-emergence herbicide in sugar beets. Swanson, C. R. and E. A. Helgeson. Applied as a pre-emergence treatment at 4, 8 and 12 pounds per acre, maleic hydrazide retarded growth of annual grass weeds at the two higher rates but did not kill them. There was also some indication of retarded beet growth at the highest rate. When applied at 2, 4, and 8 pounds per acre as a post-emergence application to beets in the 4 to 6 leaf stage with grass weeds (Setaria and wild oats) 8 to 10 inches tall, there was no immediate effect on beets or weeds. After several weeks, most of the beets had died and those few remaining had narrow strap-shaped leaves. Grass weeds treated with 2 pounds per acre were short and slow to mature. Maleic hydrazide at 4 and 8 pounds per acre stopped further growth of the grasses but did not kill them. Very little seed was set by weedy grasses treated with the higher rate of herbicide. (Contri. Div. of Weed Investigations, BPISAE, U. S. Dept. of Agric. and N. D. Agr. Exp. Station.)

Top killing of alfalfa with herbicides. Sylwester, E. P. and Hoffman, O. L. Cooperative preliminary work with herbicides of a primarily non-systemic nature were undertaken in 1950 in conjunction with the Department of Agronomy and Entomology in order to kill green weeds and alfalfa so that the alfalfa for seed could be combined directly without cutting and windrowing, thereby eliminating some loss of seed due to shattering. The following materials and dosages were used, when alfalfa was ready for harvest: (1) Dinitro ortho secondary butyl phenol in oil 1 qt/A. (2) Potassium Cyanate in water, 15 lbs./A. (3) Pentachlorophenol (10%) in oil, 3 gal/A. (4) Dow Defoliant in water 6 lbs/A. (5) 3,6 endoxo-tetra hydro phthalic acid in water, 2 lbs/A. (6) Chlorate-borax in water, 6 lbs/A. Under conditions of experiment treatment #1 was most effective. The foliage was killed and combining was made easier. No effect was noted in the germination of the seed. Germination experiments on other treatments are in process at the present time. Additional work needs to be done to see if this top killing of alfalfa and direct combining has an application in alfalfa seed production. The method has been used commercially by at

least one grower with good results. (Contributed by Iowa State College.)

Pre-emergence chemical control of weeds in gladiolas. Taylor, Clifford E. Gladiolas var. "Maid of Orleans" growing in silt loam soil was treated on May 20 (2-8 days before emergence) with various pre-emergence herbicides. Treatments included NH_4-DNOSBP at 6 pounds, DNOSBP-amine salt at 4, 6 and 8 pounds, Na-2,4-D at 1 pound, NH_4-DNOSBP at 6 pounds plus Na-2,4-D at 1 pound, each in 100 gallons of water per acre, Stoddard solvent at 60 gal. fortified with PCP at 4 pounds per acre, plus unsprayed checks. There was an occasional small weed present at time of treatment. The soil surface was dry and the temperature 68°F. For the week prior to treatments the mean temperature was 55°F. with no rainfall. For the two weeks following treatments the mean temperature was 63°F. and the rainfall: 5/22 - 0.04", 5/23 - 0.03", 5/26 - 0.02", 5/30 - 0.08", 6/1 - 0.04", 6/3 - 0.08", 6/4 - 1.03" and 6/5 - 0.04". Major weeds present were pigweeds (Amaranthus spp.) and purslane (Portulaca oleracea). Total weed control was 87% with NH_4-DNOSBP at 6 lbs., 84%, 82% and 95% with DNOSBP-amine salt at 4, 6 and 8 lbs. respectively, 82% with Na-2,4-D at 1 lb., 90% with the combination of NH_4-DNOSBP and Na-2,4-D, and 81% with the fortified Stoddard solvent. However, weed populations were too varied for statistically significant control. The dinitros at 6 and 8 pounds per acre noticably improved the foliage color and vigor and flower substance of the gladiolas. At the early bud stage there seemed to be a slight stunting effect to the gladiolas on the Na-2,4-D plots, but this effect was not discernible when in full flower. There was no flower stalk curvature from any treatment. There was no statistically significant effect on bulb size or bulblet number of the gladiolas from any treatment. (Contri. of the Illinois Agr. Exp. Station, Urbana, Illinois.)

Pre-emergence chemical control of weeds in peonies. Taylor, Clifford E. Treatments were applied to peonies in a silt loam soil, on May 6. An occasional peony shoot had emerged, some up to two inches. The temperature was 56°F. and the soil surface moist. For the week prior to treatment the mean temperature was 51°F. and the rainfall: 5/1 - 0.04", 5/4 - 0.32" and 5/5 - 0.02". For the two weeks following treatments the mean temperature was 57°F. and the rainfall: 5/6 - 0.17", 5/9 - 0.23" and 5/10 - 0.01". Weeds were mostly pigweeds (Amaranthus sps.) and grasses, and the remainder various annuals and perennials. The grasses and a few broad-leaf weeds had emerged at the time of treatments. Treatments included Na-2,4-D at 1 and 1½ pounds, NH_4-DNOSBP at 6½ pounds, Na-2,4-D at 1 pound plus NH_4-DNOSBP at 5 pounds, Na-2,4-D at 1½ pounds plus NH_4-DNOSBP at 6½ pounds, all in 100 gallons of water per acre, Stoddard solvent at 80 gallons, and Stoddard solvent at 80 gallons fortified with PCP at 8 pounds per acre, and untreated checks. Small grasses were killed by the Stoddard solvent alone, but the fortified solvent killed or controlled all grasses. The other treatments did not control grasses. Control of broad-leaf weeds four weeks after treatments was complete with the fortified solvent and all treatments containing dinitro, fair on the Na-2,4-D plots and poor when the solvent was used alone. Peonies emerged before treat-

ment showed occasional shallow "spot-burning" of the shoot from Stoddard solvent but there was no evidence of injury to the stalk proper or to the enclosed flower bud. There were no visible detrimental affects to the peonies from any treatment. There was a definite increase in vigor and leaf greenness on the dinitro-treated plots. (Contribution of the Illinois Agricultural Exp. Station, Urbana, Illinois)

Pre-emergence chemical control of weeds in sugar beets. Taylor, Clifford E. Sugar beets were planted June 6, on sandy clay-silt loam. Treatments were applied June 9, with emergence June 12-18, and harvest October 12. Treatments included Na-TCA at 4, 8 and 12 pounds, Na-2,4-D at ½ pound (eq/a) and KOCN at 16 pounds, all in 100 gallons of water per acre, Stoddard solvent at 60 gallons fortified with PCP at 4 pounds per acre, plus unsprayed checks. There were no weeds present at time of treatment. The soil surface was dry, temperature 86°F. For the week prior to treatments the mean temperature was 69°F. and the rainfall: 6/2 - 2.35". For the two weeks following treatments the mean temperature was 67°F. and the rainfall: 6/9 - 0.74", 6/13 - 1.10", 6/15 - 0.36", 6/16 - 0.79", 6/18 - 1.12", 6/19 - 0.01" and 6/24 - 2.31". The weeds were quite varied in both kinds and numbers through this experiment, and consisted mostly of pigweeds (Amaranthus sps.), annual grasses, purslane (Portulaca oleracea), Lambsquarters (Chenopodium album), and buttonweeds (Malva rotundifolia). There was no significant control of total weeds after four weeks, from any treatment. However control of the grasses was excellent at all three rates of Na-TCA. The Na-2,4-D at ½ pound per acre very significantly reduced the beet stand. Beets harvested from these plots were very significantly reduced in number and increased in average weight per beet, with the ton per acre yield being lowered, but not to a significant degree. There was no significant effect on the stand, yield or average weight per beet from any of the other treatments. (Contri. of the Illinois Agr. Exp. Sta., Urbana, Illinois)

Chemical control of quack grass (Agropyron repens). Taylor, Clifford E. Quack grass growing in a silty clay-loam soil was treated on July 3, when the quack grass was two feet tall. At the time of treatment it was sunny, with a 72°F. temperature. For the week prior to treatments the mean temperature was 66°F. and the rainfall: 6/29 - 0.14" and 7/2 - 0.03". For the week following treatments the mean temperature was 70°F. and the rainfall: 7/5 - 0.03". Treatments were applied to thoroughly wet the quack grass foliage. Stoddard solvent alone, or fortified with PCP at 10 pounds per 100 gallons solvent or NH_4-DNOSBP at 10 pounds per 100 gallons solvent all killed the quack grass foliage, but regrowth occurred later in the summer. Na-2,4-D at 4 pounds per 100 gallons water caused some yellowing and stunting of the quack grass foliage. KOCN in water at 2% and Na-PCP at 10 pounds per 100 gallons water were ineffective. (Contri. of the Illinois Agr. Exp. Station, Urbana, Illinois.)

Post-emergence chemical control of weeds in onions (greenhouse preliminaries). Taylor, Clifford E. Plots down greenhouse benches containing Southport Yellow Globe seedlings and Golden Globe onions from sets were treated 44 days after planting. Treatment day was partly cloudy with a temperature of 68-74°F. Plots were watered by overhead sprinkling two days before and one day after treatments. The majority of the seedlings were in the 3rd-true-leaf stage. Diesel oil at 100 gal. per acre: 77% weed control but severe burn to all onions. Sulfuric acid at 2½% in 100 gal. water per acre: 52% weed control and slight tip burn to the onions. Na-PCP at 1, 2½ and 4 lbs: 47, 67 and 83% weed control, none, slight and moderate burn to onions from sets, very slight to moderate tip burn on onions from seed. PCP at 1% in 100 gal. diesel oil per acre: 100% weed control and complete kill of onions. Sinox at 3 pints: 23% weed control, no injury to onions from sets, very slight tip burn to onions from seed. Dow Selective at 3 pints, alone and with a spreader-sticker: 5% and 75% weed control, slight tip burn to onions. Na-2,4-D at ¼, ½ and 1 lb. and at ¼ and ½ lb. with a spreader-sticker: 7% - 43% weed control, slight to severe curling of the onions leaves. Stoddard solvent at 40 and 80 gals. per acre: 63 and 95% weed control, moderate to severe burning of onions. KOCN at 1% and 2%: 50 and 60% weed control, no injury to onions at 1% and a slight tip burn at 2%. NaCl at 25% in 100 gals. water per acre, alone and with a spreader-sticker: 53 and 73% weed control, and slight tip burn to the onions. Only Na-PCP at 2½ lbs. per acre, KOCN at 2%, Dow Selective at 3 pts. and NaCl at 25%, both with a spreader-sticker and both with water at 100 gallons per acre, were the only treatments appearing encouraging. (Contribution of the Illinois Agri. Exp. Station, Urbana, Illinois.)

Post-emergence chemical control of weeds in onions. Taylor, Clifford E. Onions from seed (Southport Yellow Globe) and from sets (Golden Globe) were sprayed on June 5 (29-32 days after emergence). The soil surface was moist and the vegetation dry, sunny, temperature 70-78°F. The mean temperature the week prior was 70°F. and the rainfall 0.70". Mean temperature the next week was 66°F., with no rain. Treatments included NH_4-DNOSBP at 3/8 lb. and 25% NaCl, each alone and with a spreader-sticker, Na-PCP at 2½ and 4 lbs., all in 100 gallons of water per acre, and 1% and 2% KOCN in 60 gallons of water per acre. Weeds were mostly pigweeds (*Amaranthus* sps.) and purslane (*Portulaca oleracea*). The only weed control was some "spot-burning" of the pigweeds by the two NaCl and the 2% KOCN treatments, with the onions "spot-burned" by Na-PCP at 4 lbs. The same treatments and rates were applied to the same plots on June 11 (6 days later), with soil surface and vegetation being dry, sunny and a temperature of 85°-92°F. Mean temperature for the next week was 70°F. with 4.43" rainfall. Results were similar to those above. On June 30 (19 days after the second spraying) the same chemicals were applied to the same plots again, but with an increase in the NH_4-DNOSBP rate to 3/4 lb. KOCN to 3% and 4% and the Na-PCP to 5 and 8 lbs. Mean temperature the prior week was 75°F., with 0.46" rainfall. Mean temperature the next week was 79°F., with 0.83" rainfall. The soil surface and vegetation were dry, and the day sunny with a temperature of 87-95°F.

Na-PCP at 8 lbs. stunted the purslane and killed all other weeds and the onions. KOCN at 4% killed all weeds except purslane. All weeds except purslane were severely "burned" by the NH_4-DNOSBP and NaCl treatments, KOCN at 3% and Na-PCP at 5 lbs. The onions were severely "burned" by all but the NaCl treatments. (Contribution of the Ill. Agri. Exp't. Station, Urbana, Illinois.)

Post-emergence chemical control of weeds in onions (Koehler farm) Taylor, Clifford E. Golden Globe onion seed was planted April 20, for sets, on a silty clay-loam soil, with emergence May 12 - 14. Post-emergence treatments were applied on June 4, 5:00-5:30 p.m., cloudy at the time, and the temperature 66-68°F. The mean temperature for the prior week was 62°F. and the rainfall 5/30 - 0.08", 6/2 - 1.26", and 6/3 - 1.62". Mean temperature for the following week was 72°F. and the rainfall: 6/10 - 0.01". The major weeds present were lambsquarters (Chenopodium album) - small to 3 inches high with 8 leaves, and smartweeds (Rumex sps.) and pigweeds (Amaranthus sps.), small to 2½ inches high with 6 leaves. The onion seedlings were in the 3rd-true-leaf stage. Both the onions and the weeds were considered to be in a very succulent condition. Treatments, each in 100 gallons of water per acre, included NH_4-DNOSBP at 3/8 lb. KOCN at 1% and at 1½% and Na-PCP at 2½ lbs. and at 3½ lbs., plus check plots. There were no effects on the weeds or onions, and the experiment was discontinued. (Contribution of the Illinois Agr. Exp. Station, Urbana, Illinois.)

Pre-emergence chemical control of weeds in onions (greenhouse preliminaries) Taylor, Clifford E. Plots in the greenhouse containing silt loam soil were planted to Southport Yellow Globe seed and Golden Globe onion sets. Various chemical treatments, each replicated twice, were applied to one series of plots 2 days and a second series 6 days after planting. Stand and weed counts and observations were made after 4 weeks. Treatments included Na-2,4-D at ¼, ½, 1, 2 and 4 pounds per acre, Stoddard solvent at 80 gallons per acre, 1% and 3% Na-PCP in 100 gallons of water per acre, 1% and 3% PCP in 100 gallons of diesel oil per acre and Ca-cyanamide at 75 pounds per acre. No injury, or at most very slight, occurred to the onions from sets, from any treatment. With the Na-2,4-D treatments the stand was better and the onion seedling injury less when applied just before emergence than when applied earlier. Percentage of weed control was also higher at the later date. Rates as high as two pounds per acre seemed satisfactory to use on onions grown from seed. Stoddard solvent was effective in killing weeds which had emerged before application; otherwise it was of little value, having no residual effect on either weeds or onions. The percent of stand of the seeded onions was much reduced and seedling injury rather severe in all treatments using PCP or its salt. Percentage of weed kill was greater when treatments were made just before emergence. Better weed control was obtained with Ca-cyanamide when applied just before emergence rather than earlier. (Contribution of the Illinois Agri. Exp. Station, Urbana, Illinois.)

Pre-emergence chemical control of weeds in onions. Taylor, Clifford E. Southport Yellow Globe seed were planted April 28 on clay loam soil, with treatments applied May 5, emergence May 9-10 and harvest on July 30 as sets. Golden Globe sets were planted April 30, with treatments applied as above (May 5), emergence May 6-8, and harvest on July 28. There were no weeds present at the time of treatments, with the soil surface moderately dry, temperature 85-90°F. For the week prior to treatments the mean temperature was 65°F. and the rainfall: 5/2 - 0.35". For the two weeks following the mean temperature was 57°F. and the rainfall: 5/13 - 0.05", 5/15 - 0.02", 5/16 - 0.13", 5/17 - 0.24", 5/18 - 0.25", 5/19 - 0.31" and 5/20 - 0.89". Weeds present were 80% purslane (Portulaca oleracea), 3% pigweeds (Amaranthus sps.), 6% annual grasses, and 3% miscellaneous. Treatments included xanthogen disulfide at 5 pounds per acre, Na-2,4-D at ½ , 1 and 2 pounds per acre, Stoddard solvent at 80 gallons per acre and Ca-cyanamide at 75 pounds per acre. Weed control 8 weeks after treatments with the xanthogen disulfide and Stoddard solvent were zero, and with Ca-cyanamide, 3%. These plots were disked out after weed counts were made. Weed control was very significant with the Na-2,4-D at ½ pound (83%), at 1 pound (91%) and at 2 pounds (92%). No significant reduction in stand or yield of onions occurred on any of the plots with Na-2,4-D treatment. Percent of loss of Golden Globe bulbs after three months in storage failed to show any ill effects from the Na-2,4-D treatments. (Contri. of the Illinois Agr. Exp. Sta., Urbana, Illinois.)

Pre-emergence chemical control of weeds in red beets. Taylor, Clifford E. Red beets, variety Detroit Dark Red, were planted on April 29, on clay loam soil, in rows 18 inches apart, with treatments applied May 7, emergence May 9-10 and harvest on July 25. There were no weeds present at the time of treatment, with the soil surface dry, cloudy, and the temperature 50-58°F. For the week prior to treatments the mean temperature was 72°F. and the rainfall: 5/2 - 0.35". For the week following the mean temperature was 56° and the rainfall: 5/13 - 0.05", 5/16 - 0.13", 5/17 - 0.24", 5/18 - 0.25", 5/19 - 0.31" and 5/20 - 0.89". The weed population was 87% purslane (Portulaca oleracea) plus some pigweeds (Amaranthus sps.) and annual grasses. Treatments and the percent weed control for each after six weeks: Stoddard solvent at 80 gallons - 10%, Stoddard solvent at 50 gallons fortified with PCP at 15 pounds per acre - 15%, Na-PCP at 15 pounds - 73% and at 25 pounds - 84%, Na-2,4-D at ½ pound - 91% and xanthogen disulfide at 5 pounds - 47%. All treatments were per acre, and, except for the Stoddard solvent treatments, in 100 gallons of water per acre. Percent control of the purslane was 13, 82, 73, 85, 92 and 58% respectively. Total weed control was not significant for the Stoddard solvent used alone, but was very significant with all other treatments. All treatments which significantly reduced the weed population caused a very significant loss in both stand and yield of the beets. (Contribution of the Illinois Agricultural Experiment Station, Urbana, Illinois.)

Pre-emergence chemical control of weeds in horseradish. Taylor, Clifford E. Horseradish was planted on May 16, on clay loam soil, with treatments applied May 27, emergence June 3-4, and harvest October 27. There were no weeds present at the time of treatments, with the soil surface dry, cloudy, and the temperature 50°F. For the prior week the mean temperature was 54°F. and the rainfall: 5/20 - 0.89", 5/22 - 0.05", 5/24 - 0.02" and 5/26 - 0.01". For the week following the mean temperature was 65°F. and the rainfall: 6/3 - 0.68" and 6/4 - 0.02". The weeds were 86% purslane (Portulaca oleracea) plus some pigweeds (Amaranthus sps.), lambsquarters (Chenopodium album) and annual grasses. Treatments (all per acre, and in 100 gals. water per acre unless otherwise noted) and the percent weed control for each after six weeks: xanthogen disulfide at 10 lbs. - 41%, NH_4-DNOSBP at 5 lbs. - 73% and at 8 lbs. - 81%, dichloralurea at 2½ lbs. - 16%, Na-PCP at 20 lbs. - 80% and Stoddard solvent at 50 gal. per acre fortified with PCP at 5 lbs. per acre - 70%. Percent control of purslane was 50, 79, 75, 21, 82 and 67%, respectively. The weed control was not significant with the dichloralurea, significant with the xanthogen disulfide, and very significant with the other materials. There were no significant stand reductions from any of the above treatments. The dichloralurea and xanthogen disulfide plots were discontinued. Both the total weight of harvested horseradish and the weight of No. 1 roots were significantly lowered by the Stoddard solvent plus PCP treatment. There was no significant effect on yield from any other treatment. No discoloration of any kind occurred on or in the roots as a result of the treatments. (Contribution of the Illinois Agr. Exp. Station, Urbana, Illinois.)

Pre-emergence chemical control of weeds in peas. Taylor, Clifford E. Three varieties of peas were planted on April 29, on clay loam soil six seed per foot of row and rows 3 feet apart, with treatments applied May 5, emergence May 9-11 and harvest dates, Alaska and Little Marvel - June 21-29 and Laxton's Progress June 25-July 6. There were no weeds present at the time of treatment, with the soil surface moderately dry, sunny and the temperature 94°F. For the prior week the mean temperature was 65°F. and the rainfall: 5/2 - 0.35". For the next two weeks the mean temperature was 57°F. and the rainfall: 5/13 - 0.05", 5/15 - 0.02", 5/16 - 0.13", 5/17 - 0.24", 5/18 - 0.25", 5/19 - 0.31", and 5/20 - 0.89". Weeds were 95% purslane (Portulaca oleracea) plus some pigweeds (Amaranthus sps.) and some annual grasses. Treatments (all per acre, and in 100 gals. water per acre unless otherwise noted) and the percent weed control for each after 6 weeks: Na-PCP at 20 lbs. - 83%, NH_4-DNOSBP at 5 lbs. - 96% and at 8 lbs. - 98%, Na-DNO-cresylate (Sinox) at 6 gals. - 65%, xanthogen disulfide at 10 lbs. - 0% and Ca-cyanamide at 75 lbs. applied as a powder - 43%. Percent control of purslane was 84, 97 99, 62, 0 and 79% respectively. Weed control was not significant with the xanthogen disulfide or Sinox, but was significant with the Na-PCP and Ca-cyanamide and very significant with the NH_4-DNOSBP treatments. There were no reductions in stand from any treatment. The peas on the Na-PCP plots showed a marked yellowing of the foliage following rainy weather, and later the lower leaves dried up. There was a significant reduction in yield on the Na-PCP plots for the peas

Little Marvel and Laxton's Progress, but not for Alaska. The pea yields were not reduced from the other treatments. (Contribution of the Illinois Agr. Exp. Station, Urbana, Illinois.)

Chemical control of weeds in popcorn. Taylor, Clifford E. Illinois Hulless, South American and White Rice popcorn were planted on June 8 on clay loam soil, with pre-emergence treatments applied June 18, emergence June 20-22 and harvest October 1. There were no weeds present at the time of treatment, with the soil surface moist, sunny and the temperature 72-84°F. For the prior week the mean temperature was 71°F. and the rainfall: 6/14 - 0.61", and 6/15 - 3.82". For the next two weeks the mean temperature was 76°F. and the rainfall: 6/21 - 0.03", 6/25 - 0.26", 6/26 - 0.10" and 6/28 - 0.10". Weeds were 97% purslane (Portulaca oleracea) and 3% miscellaneous. Treatments (all per acre, and in 100 gals. water per acre unless otherwise noted) and the percent weed control after 6 weeks for each: xanthogen disulfide at 10 lbs. - 77%, Na-PCP at 20 lbs. - 100%, NH_4-DNOSBP at 6½ lbs. - 100% and Na-2,4-D at 1½ lbs. - 74%. Percent control of purslane was 79, 100, 100 and 75%, respectively. The weed control was very significant with all the treatments. There was only one significant effect on the stands and yields of popcorn - the yield of White Rice popcorn was very significantly increased by the use of NH_4-DNOSBP. Additional replicated plots were given a post-emergence application of Na-2,4-D at ½ lb. and at 1 lb. per acre. Applied July 5, 8-9 am, with the day sunny, and the temperature 78-85°F. The soil surface and vegetation were dry. The popcorn was about 6" high. There was 0.83" rainfall that night, and apparently as a result there was no weed control and no effects on the popcorn. These post-emergence plots were disked on July 30. (Contribution of the Illinois Agr. Experiment Station, Urbana, Illinois.)

Pre-emergence chemical control of weeds in Asparagus. Taylor, Clifford E. Plots were laid out in a nine-year-old asparagus planting, on clay loam and silty clay loam soil. At the end of the normal cutting season the field was disked, with treatments applied on June 30, before emergence had resumed. There were no weeds present at the time of treatment, with the soil surface dry, sunny and the temperature 70-94°F. For the prior week the mean temperature was 75°F. and the rainfall: 6/25 - 0.26", 6/26 - 0.10", and 6/28 - 0.10". For the next two weeks the mean temperature was 76°F. and the rainfall: 7/6 - 0.83", 7/8 - 0.06", 7/9 - 0.10", 7/10 - 0.10" and 7/14 - 1.72". The weeds were 66% pigweeds (Amaranthus sps.), 20% wild lettuce (Lactuca scariola), 11% Canadian thistles (Cirsium arvense) plus others. Treatments (all per acre, and in 100 gals. water per acre unless otherwise noted) and the percent weed control for each after 8 weeks: Na-2,4-D at 1 lb. - 80%, at 2 lbs. - 94%, at 3 lbs. - 97% and at 4 lbs. - 87%, Na-PCP at 15 lbs. - 84% and at 25 lbs. - 84%, NH_4-DNOSBP at 5 lbs. - 51% and at 8 lbs. - 66%, xanthogen disulfide at 5 lbs. - 46% and at 10 lbs. - 79%, Stoddard solvent at 50 gal. per acre plus PCP at 5 lb. per acre - 67%, and Ca-cyanamide as a dust at 100 lb. per acre - 33%. The weed control was not significant with the xanthogen disulfide at 5 lbs. and the Ca-cyanamide, significant with the NH_4-DNOSBP at 5 lbs. and very significant with all other treatments.

Control of the pigweeds for the treatments as listed above was 96, 100, 98, 100, 98, 98, 62, 82, 81, 58, 85 and 35%, respectively. There was no stalk curvature or abnormal-appearing spears or foliage on any treatment plot. There were no significant effects on the asparagus stand. (Contri. of the Illinois Agr'l. Exp. Station, Urbana, Illinois.)

Pre-emergence chemical control of weeds in various beans. Taylor, Clifford E. Beans were planted on June 1, on clay loam soil, with pre-emergence treatments applied on June 4, emergence June 8-11. Harvest date for the green snap beans (Tendergreen) and the wax beans (Pencil Pod Black Wax) was August 1-16, for the Henderson lima, September 1 and for the Triumph lima (both as dry shell), September 9. There were no weeds present at the time of treatment, with the soil surface moist, sunny and the temperature 70-78°F. The mean temperature for the prior week was 66°F. and the rainfall: 6/3 - 0.70". For the next two weeks the mean temperature was 67°F. and the rainfall: 6/14 - 0.01" and 6/15 - 3.82". Weeds were 99% purslane (Portulaca oleracea). Treatments (all per acre, and in 100 gal. water per acre unless otherwise noted) and the percent weed control after 5 weeks for each: Na-2,4-D at ½ lb. -74%, at 1 lb. - 87% and at 1½ lbs. - 86%, xanthogen disulfide at 10 lbs. - 41%, Na-PCP at 20 lbs. - 75% and NH_4-DNOSBP at 6½ lbs. - 89%. The weed control was very significant with all treatments. The xanthogen disulfide and Na-2,4-D plots at ½ lb. were discontinued. Significant effects on stands and yields: Henderson lima beans - no effects. Triumph lima beans - stand and yield reduced by Na-PCP, yields reduced by the Na-2,4-D at 1 and 1½ lbs. Wax beans - stand reduced by the Na-2,4-D at 1 lb, yields of both the wax and green snap beans reduced by the Na-PCP and the Na-2,4-D at 1 and 1½ lb. treatments. The Na-2,4-D effects on the beans were not formative, but rather a very marked increase in floral abscission. (Contribution of the Illinois Agr. Exp. Station, Urbana, Illinois)

Pre-emergence weeding of snap bean and sweet corn varietal trials with NH_4-DNOSBP. Taylor, Clifford E. Our preliminary investigations on the use of NH_4-DNOSBP as a pre-emergence herbicide in beans and sweet corn were so encouraging that it was decided to use this material on our varietal trials in 1950. The entire trial area was treated, which does not permit any statistical analysis, but a yield comparison of varieties appearing in both the 1949 and 1950 trials would seem appropriate. The 1949 varietal trials were on a clay silt loam soil, and yields were considered excellent. The 1950 trials were on a sandy clay silt loam soil. The sweet corn was planted on June 8 and the snap beans on June 9, with rows 3 feet apart in each case. NH_4-DNOSBP was applied on June 16 (2-4 days before emergence) at the rate of 10 pounds per acre, in 100 gallons of water per acre. The mean temperature for the prior week was 69°F. and the rainfall: 6/9 - 0.74", 6/13 - 1.10" and 6/15 - 0.36". For the following two weeks the mean temperature was 67°F. and the rainfall: 6/16 - 0.79", 6/18 - 1.12", 6/19 - 0.01", 6/24 - 2.31", 6/28 - 0.07" and 6/30 - 0.03". As determined by adjacent weedy areas weeds were about evenly divided among lambsquarters (Chenopodium album), pigweeds (Amaranthus sps.), purslane (Portulaca oleracea) and annual grasses, and

weed control was 98%. The trials were not cultivated or weeded. The 1949 and 1950 bean yields in tons per acre (the 1949 yield first in each case) were: Topcrop 4.1 and 5.1, Rival 3.4 and 4.4, Black Valentine 2.5 and 3.7, Logan 2.4 and 3.2, Contender 4.4 and 3.0, Tendergreen 2.6 and 2.6 and Fullgreen 3.1 and 2.5. The 1949 and 1950 sweet corn yields in tons per acre were: Golden Security 6.0 and 5.3, Improved Sencross 4.4 and 4.4, Golden Cross Bantam 5.4 and 3.8, Carmelcross 4.5 and 5.6, Ioana 4.7 and 5.2, Calumet 5.1 and 5.2, Illinois 16 3.4 and 6.4, Illinois 17 4.3 and 6.2 and Illinois 20 4.0 and 5.6. (Contri. of the Illinois Agr'l. Exp. Station, Urbana, Illinois.)

Pre-emergence weed control in sweet corn. Taylor, Clifford E. Sweet corn varieties Marcross, Our Choice, Golden Cross Bantam, Surecross, Lincoln, Ioana and Golden 60-Day were planted on June 24 on silty clay loam soil, 1½ inches deep. Pre-emergence treatments were applied June 27, with emergence June 29-July 2. There were no weeds present at the time of treatment, with soil surface moderately dry, and the day sunny with the temperature 74-85° F. For the prior week the mean temperature was 74°F. and the rainfall: 6/21 - 0.03", 6/25 - 0.26" and 6/26 - 0.10". For the next two weeks the mean temperature was 77°F. and the rainfall: 6/28 - 0.10", 7/6 - 0.83", 7/8 - 0.06", 7/9 - 0.10" and 7/10 - 0.10". Weeds were 43% pigweeds (Amaranthus sps.) and 26% purslane (Portulaca oleracea). Treatments (all per acre, and in 100 gals. water per acre) and percent weed control for each after 6 weeks: xanthogen disulfide at 10 lbs. - 0%, Na-2,4-D at 1 lb. - 81%, at 1½ lbs. - 80% and at 2 lbs. - 91%, Na-PCP at 20 lbs. - 66% and NH_4-DNOSBP at 6½ lbs. - 59%. The weed control was significant with all treatments except the xanthogen disulfide. Control of purslane was 0, 60, 92, 96, 0 and 84% respectively. Control of pigweeds was 33, 89, 84, 93, 100 and 77% respectively. There were no ill effects or significant reductions in yield (by number or weight of ears) from any pre-emergence treatment on any variety of sweet corn. (Contri. of Illinois Agr. Exp. Station, Urbana, Illinois)

Post-emergence chemical control of weeds in sweet corn. Taylor, Clifford E. Twelve varieties of sweet corn were planted on May 27 on silty clay loam soil, with post-emergence treatments applied July 1 and 2. The sweet corn varieties included Spancross, Surprise, Carmelcross, Golden 60-Day, Our Choice, Golden Sunshine, Golden Cross Bantam, Surecross, Lincoln, Marcross, Golden Bantam and Ioana. Treatments (all per acre, and in 100 gals. water per acre unless otherwise noted) were Na-2,4-D at ¼, ½, 3/4, 1, 1¼, 1½, 1-3/4 and 2 lbs., NH_4-DNOSBP at ½, 3/4 and 1 lb. and KOCN at 2, 3 and 4% in 60 gal. water per acre, plus checks. At the time of application the soil surface and vegetation were dry with no rain 48 hours either before or after, and the temperature 91-99°F. The corn was 18-28" high, and the nozzles were dropped to avoid the central whorl of corn leaves. Weeds were mostly purslane (Portulaca oleracea) to 4" high and pigweeds (Amaranthus sps.) to 14" high. Both the corn and weeds were growing vigorously and very succulent. Weed control with the Na-2,4-D: purslane - none, pigweeds - 1/2 lb. up. The yield of Golden Cross Bantam was significantly reduced by the Na-2,4-D at 1-3/4 and 2 lbs. There were no

other significant yield reductions from any Na-2,4-D rate on any sweet corn variety. Stalk curvature occurred on most varieties but could not be correlated with yield data at the various rates. Varieties resistant to stalk curvature: Carmelcross, Golden 60-Day, Golden Cross Bantam, Our Choice and Surecross. Intermediate: Spancross and Golden Sunshine. Susceptible: Surprise, Lincoln, Marcross, Golden Bantam and Ioana. There was some "burning" of both the weed leaves and the lower corn leaves at the higher KOCN and NH_4-DNOSBP rates, with lowered (usually significant yields. (Contribution of the Illinois Agr. Exp. Station, Urbana, Illinois)

Pre-emergence chemical control of weeds in various vine crops. Taylor, Clifford E. Table Queen and Green Delicious squash, Hearts of Gold muskmelon, Marketeer cucumber, Kleckley Sweet No. 6 watermelon and field pumpkins were planted June 2 on clay loam soil, with pre-emergence treatments applied June 8 and emergence June 10-12. There were no weeds present at the time of treatments, with the soil surface dry, sunny, and the temperature 45-65°F. For the prior week the mean temperature was 68°F. and the rainfall: 6/3 - 0.68". For the next two weeks the mean temperature was 71°F. and the rainfall: 6/14 - 0.61", 6/15 - 3.82" and 6/21 - 0.03". Weeds were 97% purslane. Treatments (all per acre, and in 100 gals. water per acre unless otherwise noted) and the percent weed control for each after 4 weeks: xanthogen disulfide at 10 lbs. - 0%, Na-PCP at 20 lbs. - 62%, NH_4-DNOSBP at 5 lbs. - 75% and at 8 lbs. - 85%, Na-2,4-D at ½ lb. - 63% and Stoddard solvent at 50 gal. per acre plus PCP at 5 lbs. per acre - 16%. The percent control of purslane was 0, 61, 77, 86, 63 and 14%, respectively. Weed control was not significant with the xanthogen disulfide and fortified solvent, but very significant with the other treatments. The Na-2,4-D and fortified solvent plots were discontinued. None of the crops were significantly reduced in stand by the xanthogen disulfide or Na-2,4-D treatments. The only treatments giving significant weed control and which did not significantly reduce stand and/or yield: Table Queen squash - none, Green Delicious squash - none, muskmelon - none, pumpkin - Na-PCP at 20 lbs., and the cucumber - NH_4-DNOSBP at 5 lbs. Stands were not significantly reduced on the watermelons by the two rates of NH_4-DNOSBP, but yield data was not available. (Contribution of the Illinois Agr. Exp. Station, Urbana, Illinois.)

Pre-emergence chemical control of weeds in potatoes. Taylor, Clifford E. Early Ohio, Pontiac, Red Triumph, Chippewa, Katahdin and Rural New Yorker potatoes were planted on May 12 on clay loam soil, with emergence May 31-June 3. Pre-emergence treatments were applied on May 25. There were no weeds present at the time of treatment, with the soil surface moderately dry, cloudy and the temperature 42-48°F. For the prior week the mean temperature was 56°F. and the rainfall: 5/18 - 0.25", 5/19 - 0.31", 5/20 - 0.89", 5/22 - 0.05" and 5/24 - 0.02". For the two weeks following the mean temperature was 63°F. and the rainfall: 5/26 - 0.01", 6/3 - 0.68" and 6/4 - 0.02". Weeds were 93% purslane (Portulaca oleracea) plus some lambsquarters (Chenopodium album) and pigweeds (Amaranthus sps.). Treatments (all per acre, and in 100 gal. water per acre) and the percent weed control of each after 6 weeks; Na-2,4-D at ½

lb. - 27%, at 1 lb. - 25% and at 2 lbs. - 69%, xanthogen disulfide at 10 lbs. - 78%, Na-PCP at 20 lbs. - 84% and NH_4-DNOSBP at 6½ lbs. - 90%. Control of purslane was 24, 26, 68, 82, 83 and 91%, respectively. Weed control was not significant with the two lower rates of Na-2,4-D and these plots were discontinued. There was moderate temporary leaf curling at the 2 lb. rate of Na-2,4-D on the Pontiac and Rural New Yorker potatoes. The yields of Chippewa and Rural New Yorker potatoes were significantly lowered by Na-2,4-D at 2 lbs. There were no other significant effects on yields of any variety from any treatment. (Contri. of the Illinois Agr. Exp. Station, Urbana, Illinois.)

Average percent weed control obtained from various pre-emergence treatments on field plots. Taylor, Clifford E. Weed control obtained with any pre-emergence herbicidal treatment is influenced considerably by both environment and kinds of weeds. Weeds on our vegetable experimental plots have averaged 88% purslane (Portulaca oleracea), 7% pigweeds (Amaranthus sps.) and some lambsquarters (Chenopodium album), smartweeds (Rumex sps.), annual grasses and others. In a total of 233 plots given various pre-emergence herbicidal treatments the treatments (per acre basis) and average percent weed control were as follows: Na-2,4-D at ¼ lb. - 28%, ½ lb. - 58%, 1 lb. - 70%, 1½ lbs. - 74%, 2 lbs. - 77%, and 4 lbs. - 82%, Na-PCP at 15 lbs. - 78%, 20 lbs. - 81% and 25 lbs. - 84%, NH_4-DNOSBP at 5 lbs. - 74%, 6½ lbs. - 91% and 8 lbs. - 83%, xanthogen disulfide at 5 lbs. - 30% and 10 lbs. - 47%, and Stoddard solvent at 50 gals. fortified with PCP at 5 lbs. - 58%. Control of purslane: Na-2,4-D at ½ lb. - 66%, 1 lb. - 58%, 1½ lbs. 84% and 2 lbs. - 82%, Na-PCP at 15 lbs. - 73%, 20 lbs. - 69% and 25 lbs. - 85%, NH_4-DNOSBP at 5 lbs. - 84%, 6½ lbs. - 91% and 8 lbs. - 87%, xanthogen disulfide at 5 lbs. - 58% and 10 lbs. - 36% and Stoddard solvent at 50 gals. plus PCP at 5 lbs. - 40%. Control of pigweeds: Na-2,4-D at ½ lb. - 55%, 1 lb. - 79%, 1½ lbs. - 79%, 2 lbs. - 96% and 4 lbs. - 100%, Na-PCP at 15 lbs. - 98%, 20 lbs. - 100% and 25 lbs - 98%, NH_4-DNOSBP at 5 lbs. - 52%, 6½ lbs. - 77% and 8 lbs. - 82%, xanthogen disulfide at 10 lbs. - 45% and Stoddard solvent at 50 gals. plus PCP at 5 lbs. - 85%. Control of lambsquarters: Na-2,4-D at ½ lb. - 77%, 1 lb. - 76%, and 1½ lbs. - 92%. Control of smartweeds: Na-2,4-D at ½ lb. - 16%, 1 lb. - 50% and 1½ lbs. - 51%. (Contri. of the Illinois Agr. Exp. Station, Urbana, Illinois.)

Effects of temperature and moisture on weed control obtained with various pre-emergence herbicides on vegetable plots. Taylor, Clifford E. Temperature, rainfall and soil moisture data were recorded as each series of pre-emergence herbicidal treatments was applied. Weed control on a total of 159 plots of Na-2,4-D at ½, 1 and 1½ lbs., Na-PCP at 20 lbs., NH_4-DNOSBP at 6½ lbs. and xanthogen disulfide at 10 lbs. per acre treatments were correlated with weather factors. The overall average on the weeds was 88% purslane (Portulaca oleracea), 7% pigweeds (Amaranthus sps.), and some lambsquarters (Chenopodium album), smartweeds (Rumex sps.), annual grasses and others. Temperatures on the day of application and in the few days following application may conceivably affect the dissipation or reaction of the chemical film on the soil surface, and temperatures around the treatment date have a considerable effect

on the relative proportions of dormant and germinating weed seed. With Na-2,4-D temperatures above 70°F. on the day of pre-emergence treatments and the days before and after gave markedly better weed control. Weed control with Na-PCP and xanthogen disulfide was slightly better when the mean temperature was above 70°F. the days before and below 70° after application. Control with NH_4DNOSBP was considerably better when the mean temperature was below 70°F. both before and after treatments. Moisture appeared to be the most important weather factor in the percent of weed control obtained from pre-emergence treatments. Moisture affected the surface chemical film in relation to its depth, rate of downward movement, rate of dilution and inactivation. Moisture also affected the relative numbers of dormant or germinating weed seeds. Weed control with Na-2,4-D was much better when the rainfall was less than one inch the week before application and more than one inch the week or two following. Control with Na-PCP and NH_4-DNOSBP was markedly better when more than an inch of rainfall occurred the week prior to application and less than an inch in the following period. Xanthogen disulfide seemed especially critical of the moisture factor, giving effective weed control only when the rainfall was above an inch in the week before application and less than an inch in the two weeks following. (Contri. of the Illinois Agr. Exp. Station, Urbana, Illinois)

Residual toxicity of herbicides applied at pre-emergence rate levels. Taylor, Clifford E. The following treatments were applied on replicated field plots on July 1 (all as active ingredient, per acre): Na-2,4-D at 1, 2, 3 and 4 lbs., Na-PCP at 15 and 25 lbs., NH_4-DNOSBP at 5 and 8 lbs., xanthogen disulfide at 5 and 10 lbs. and Stoddard solvent at 50 gal. fortified with PCP at 5 lbs. Five flats of soil from the upper three inches of soil surface were removed from each field treatment on October 10 (100 days from treatment date). The following test vegetables were planted in each flat: Purple Top White Globe turnip, Va. Blight Resistant Spinach, Southport Yellow Globe onion, Tendergreen snap beans, Wisconsin 55 tomato, Hollow Crown parsnip, Our Choice sweet corn and "A & C" cucumber. The soil was a silty clay loam of excellent texture. Total rainfall for the 100 days was 9.71" and the mean temperature 70°F. There were no significant reductions in emergence or stand of the eight test vegetables. The seedlings were thinned to uniform stands and then permitted to grow 6-8 weeks before harvest. Plant growth (fresh plant weight) was significantly reduced on the turnips, sweet corn, cucumbers and tomatoes from the 2, 3, and 4 lb. rates of Na-2,4-D, with the cucumber growth also reduced from the fortified solvent treatment. The growth of snap beans, spinach, parsnips and onions showed no significant effects from any of the soil treatments. (Contribution of the Illinois Agricultural Experiment Station, Urbana, Illinois.)

Pre-emergence use of NH_4-DNOSBP on sweet corn and peas. Taylor, Clifford E. Golden Cross Bantam sweet corn and Alaska peas were planted in an experiment with variables including planting at 1½ and 2½ inches deep, heavy and normal watering, application of NH_4-DNOSBP immediately after, 3 days after and 6 days after planting and at 4, 6½ and 9 lb. per acre rates, plus checks for both

depths of planting and both rates of watering, giving 40 treatments replicated 3 times. There was no significant stand reduction for either the sweet corn or peas from any treatment. Fresh plant wt. after 6 weeks for the sweet corn showed significant reductions at 1) 1½ " deep, heavy watering, application 6 days after planting at both the 6½ and 9 lb. rates, 2) 2½" deep, average watering, application on planting date at 9 lbs. and 3) 2½" deep, heavy watering, application 6 days after planting at the 9 lb. rate. At the late application date the sweet corn after emergence was wilted-appearing and tended to collapse, and the leaves tended to remain furled. On the peas fresh plant weight after 6 weeks showed a significant reduction at the 1½" deep, average watering, 9 lb. on planting date treatment, and in most of the treatments applied just before emergence at the 6½ and 9 lb. rates. In these cases the peas were just at or under the soil surface and the growing tips were killed back. In about ten days growth resumed from a lateral growing point located about a half inch below the soil surface and subsequent growth was normal. The data indicates that deeper planting and application mid-way between planting and emergence favor the successful pre-emergence use of NH_4-DNOSBP in sweet corn and peas, with the amount of watering after treatments making little difference. (Contri. of the Illinois Agr. Exp. Station, Urbana, ILL)

Pre-emergence weed control in red beets with TCA and PCP. Tibbitts, T. W. and Holm L. G. Beets (Asgrow Canner) were planted on July 28 on Miami silt loam soil in a three replication ransomized test. All of the chemicals used in the experiment were applied on August 1. Rainfall amounting to 0.1" fell during the 72 hours following treatment. Pigweed (Amaranthus retroflexus) was the predominant weed in the area during this period although many other annual weeds (both broadleaves and grasses) appeared. Stand counts of both beets and weeds were made on September 22 and the plots, with the exception of the unweeded control, were maintained free from weeds thereafter. The beets were harvested on October 20. TCA (sodium salt) was applied at the rate of 12, 16 and 20 pounds of acid equivalent per acre in 40 gallons of water. The stands of weeds were reduced to 76, 32 and 28 percent respectively of the unweeded control. There was little variation in the yield of beets at the three different rates but the two higher concentrations reduced the stands significantly. The yield of the treated plots was about 80 percent of that obtained from the weeded control plots. PCP (sodium salt) was applied at the rate of 8, 12, and 16 pounds of active ingredient per acre. The weed stands were reduced by 34, 47, and 21 percent respectively. The yields and numbers of beets per plot were reduced significantly by the 12 and 16 pound treatments. The 8 pound treatment caused some reduction in the number of beets and the yield was about 80 percent of that obtained from the weeded control plots. The above data on TCA and PCP were verified in another experiment conducted on the same type of soil in an outlying area of the state earlier in the season. The latter experiment was designed to investigate the effect of the chemical on the yield of beets only and the plots were therefore kept free from weeds at all times. The following combinations of TCA and PCP were also included in the upland experiment: TCA 8 pounds mixed with 2,4, and 8 pounds of PCP; TCA 12 pounds with 2 and 4 pounds of

PCP; TCA 16 pounds with 2 and 4 pounds of PCP; and TCA 20 pounds with 2 pounds of PCP. All of these treatments gave excellent weed control and did not reduce the beet stands significantly. With the exception of the combinations listed below, however, they all reduced the yield of beets by 30 to 50 percent. Sixteen pounds of TCA with 2 pounds of PCP and 20 pounds of TCA with 2 pounds of PCP gave yields which were lower than the controls but not significantly so. The 8 pounds of TCA and 2 pounds of PCP permitted a yield of beets equal to that of the weeded control plot. In view of the relative effectiveness of PCP on broadleaves and TCA on grasses, it would appear that the tolerance of red beets to the above combinations is worthy of further investigations. (Contrib. of the Dept. of Horticulture, Univ. of Wis. Agr. Exp. Station, Madison, Wisconsin.)

Control of barnyard grass and green foxtail in seed alfalfa. Viehmeyer, Glenn, Ramig R. E. and Portz, L. C. 1/ Various herbicides, in a randomized block design of five replications, were applied to an established stand of alfalfa immediately following removal of the first cutting. Per acre dosages of 2 & 4 gals. of PEC (polychloro aryl-alkyl carbonate) in tractor fuel; 15 & 30 lbs. of NIX (Sodium isopropyl xanthate) in water; 10, 15, & 20 lbs. of TCA in water, 2, 4, & 8 lbs. of Carbide & Carbon's EH 5722 in water; and 3 pts. of Sinox General in water, 1 part oil to 3 parts water, and in oil alone were used. All chemicals were diluted to give an application rate of 60 gals. per A. Effects on barnyard grass (Echinocloa Crus-Galli, Beauv.) Green foxtail (Setaria viridis, Beauv.) and the crop plant were observed. NIX at both rates, and Sinox in water were ineffective. PEC at both rates and Sinox in oil and in oil and water killed all vegetation above ground at time of application but failed to prevent reinfestation with grassy weeds from late germinating seeds. EH 5722 was partially effective at the 2 & 4-pound rates, and gave complete control at the 8 lb. rate. TCA gave complete control at all rates. Both TCA and EH 5722 gave some control of (Kochia sconaria, Roth.) though no data was taken on degree of control secured. Crop injury in the form of tip-burn and distortion of leaves and stems of shoots above ground at time of treatment was observed. No such injury was apparent on shoots emerging after treatment. Seed yields were not taken due to the crop being destroyed by hail. The 1950 results appear promising but additional studies on residual effects on soil, cumulative effect on the crop plant, and most effective dosages of TCA and EH 5722 must be made before recommendations for field use are made. (Contrib. of North Platte Sub-Station, Uni. of Nebr. 1/ Assistants in Horticulture and Agronomy and Mgr, Great Plains Farms respectively.)

Crabgrass control in muskmelons. Warren, G. F. Purdue 44 muskmelons transplanted May 15 into a fine sand soil were sprayed June 6 with TCA at 2 and 4 lbs., maleic hydrazide at 4 lbs., dichloral urea at 6 and 12 lbs., and N-1-naphthyl phthalamic acid at 2 and 4 lbs. per acre. Treatments were replicated 4 times and all materials were applied in water at the rate of 50 gal. per acre. At the time of application, the muskmelons were in bloom but no fruit had set and all weeds had been removed by cultivation and

hoeing. Several showers of less than one-half inch each occurred during the three weeks after spraying. Dichloral urea at 12 lbs. and N-1-naphthyl phthalamic acid at both rates gave 75 to 80 percent reductions in crabgrass (Digitaria spp.) counts made August 22. Dichloral urea at 6 lbs. gave a 55 percent and TCA at both 2 and 4 lbs., a 42 percent reduction compared with the check. The maleic hydrazide treatment resulted in a large increase in the crabgrass population which was apparently due to the fact that this treatment stopped growth of the muskmelon plants for about three weeks resulting in less shading of the ground. The other treatments caused little or no apparent injury to the muskmelon foliage. The total yield of melons was not significantly affected by any treatment except maleic hydrazide which resulted in almost a complete crop failure. However, maturity was delayed considerably by TCA at the 4 lb. rate. N-1-naphthyl phthalamic acid and dichloral urea were the most promising materials included in this experiment for the control of crabgrass in muskmelons. (Dept. of Horticulture, Purdue University, Agr. Exp. Station, Lafayette, Indiana.)

Crabgrass control in sweet potatoes. Warren, G. F. Yellow Jersey sweet potatoes transplanted May 8 into a fine sand soil were sprayed May 16 with TCA at 2 and 4 lbs., dichloral urea at 6 and 12 lbs., maleic hydrazide at 4 lbs., IPC at 8 and 16 lbs., and N-1-naphthyl phthalamic acid at 2 lbs. per acre. Treatments were replicated 4 times and all materials were applied in water at the rate of 50 gal. per acre. Only a small percentage of the crabgrass (Digitaria spp.) had emerged when sprays were applied. Rainfall totalling 1.05 inches occurred May 21. TCA at 4 lbs., dichloral urea at both rates and N-1-naphthyl phthalamic acid gave 85 to 90 percent reductions in crabgrass counts made June 15. TCA at 2 lbs. gave a 65 percent reduction. IPC at both rates and maleic hydrazide did not significantly reduce the number of crabgrass plants present. Weeds were removed from all plots on June 15 and a second count made July 6. Dichloral urea at both rates and N-1-naphthyl phthalamic acid gave 65 to 75 percent reductions in the number of crabgrass plants that emerged between June 15 and July 6. The other treatments did not give counts significantly lower than the check. TCA and dichloral urea caused severe distortion of the sweet potato leaves, the injury being most severe at the higher rates of application. The plants resumed normal growth after six to ten weeks. Maleic hydrazide stopped growth of the sweet potatoes completely for about three months. N-1-naphthyl phthalamic acid caused slight formative effects from which the plants recovered quickly. IPC had no visible effect on the foliage. The yield of No. 1 sweet potatoes was significantly reduced by TCA at 4 lbs., dichloral urea at 12 lbs., and maleic hydrazide. N-1-naphthyl phthalamic acid at 2 lbs. per acre was the most promising treatment included in this experiment for control of crabgrass in sweet potatoes. (Department of Horticulture, Purdue University, Agricultural Dept., Lafayette, Indiana.)

Pre-emergence weed control in direct-seeded tomatoes. Warren, G. F. A replicated experiment was conducted on a medium colored silt loam soil in which crabgrass (Digitaria spp), yellow foxtail (Setaria lutescans) and pigweed (Amaranthus retroflexus) were sown broadcast on May 9. Rutgers tomatoes were seeded direct-

ly in this field immediately afterward. On May 23, PCP (9.4% in oil) at 2½ and 5 gal. per acre, sodium isopropyl xanthate at 8 and 16 lbs., DNOSBP (phenol) at 0.5 and 1 lb., PEC (formulation of a polychloro aryl-alkyl carbonate) at 2 gal., TCA at 2 and 4 lbs., TCA at 2 lbs. combined with PCP (9.4% in oil) at 2½ gal., and TCA at 2 lbs. combined with sodium isopropyl xanthate at 8 lbs. were applied in 50 gal. of water per acre. Most of the pigweeds but only a few of the grasses had emerged at time of treatment. Over one inch of rain fell a few hours after the treatments were applied, and tomatoes emerged from 1 to 3 days later. Weed and tomato stand counts were made four weeks after spraying and all plots were then thinned and hoed. TCA alone or in combination with sodium isopropyl xanthate killed 70 to 80% of the grasses and severely stunted the remainder. Control was good but counts somewhat higher where TCA was combined with PCP. No other treatments gave appreciable control of grasses. All treatments gave from 70 to 85% reductions in pigweed counts except TCA alone at both rates, sodium isopropyl xanthate at 8 lbs., and DNOSBP at 0.5 lb. which gave less than 60% reductions. The tomato stand was reduced 30, 50, 56, 87 and 90% by 2½ gal. PCP, 5 gal. PCP, 2 gal. PEC, 0.5 lb. DNOSBP and 1 lb. DNOSBP respectively. No other treatments significantly reduced the stand. TCA, especially at the 4 lb. rate, caused some stunting and chlorosis of the tomato plants early in the season. DNOSBP at both rates were the only treatments that reduced the yield significantly. The treatments which showed most promise were those in which TCA at 2 lbs. per acre was combined with either PCP at 2½ gal. or sodium isopropyl xanthate at 8 lbs. (Dept. of Horticulture, Purdue University, Agr. Exp. Sta., Lafayette, Ind.)

Post-emergence weed control in onions. Warren, G. F. and Ellis, N. K. Several replicated experiment were conducted on muck soil in 1949 and 1950 to study the effect of material, rate and time of application, and weather conditions on weed control and injury to Early Yellow Globe onions. Of the materials tested, 2 to 3% sulfuric acid applied at the rate of 100 gal. per acre gave most consistant weed control with least injury to the onions. Pigweed, smartweed and ragweed were easily killed by this treatment if not over one inch tall and purslane was killed in the cotyledon stage. Lambsquarters and annual grasses were not controlled. Phosphoric acid at 12 to 15% gave similar results but would be much more expensive. Ten pounds of potassium cyanate applied in 50 or 100 gal. of water per acre resulted in about as good control as sulfuric acid when weeds were small and succulent but much poorer control when weeds were large or were less succulent. Several other materials were tried but none gave as good results as these. Onions were more resistant to injury in the "knee" or "loop" and in the one-or-two-true-leaf stage than in the "flag" stage. They were more subject to injury at any stage of growth if the weather had been moist and cloudy during the two or three days before spraying. Reductions in yield were generally proportional to the amount of observed injury. Based on these experiments it seems wise to avoid spraying in the flag stage but otherwise to spray when the weeds are small. Spray concentration should be lower when growth is succulent than when the plants are hard. (Dept. of Horticulture, Purdue Univ., Agr. Exp. Station, Lafayette, Indiana.)

Pre-emergence weed control in onions. Warren, G. F. and N. K. Ellis. A replicated experiment was conducted on Early Yellow Globe onions planted about 1¼ inches deep in muck soil on April 21. On May 6 (just before onion emergence) the following treatments were applied in 50 gal. of water per acre: 2,4-D, amine, 0.5 and 1 lb, per acre; disodium 3,6-endoxohexahydrophthalate, 1 and 2 lbs.; maleic hydrazide, 4 and 8 lbs.; IPC, 8 lbs.; PCP (9.4% in oil), 2½ gal.; sodium isopropyl xanthate, 16 lbs.; TCA, 2 lbs.; and sulfuric acid, 5%. A windstorm the day before treatments were applied killed all weeds that had emerged. There was practically no rain during the two weeks following treatment but about one inch of water was applied, by overhead irrigation on May 15. Weed counts were made June 6 and all plots were hand weeded thereafter. Weed species present, in order of importance, were annual grasses, pigweed (Amaranthus retroflexus) and purslane (Portulaca oleracea). Disodium 3,6-endoxohexahydrophthalate at 2 lbs. per acre and 2,4-D at 0.5 and 1 lb. gave 55 to 65 percent reductions in the total number of weeds. No other treatments reduced the weed population by over 40 percent. None of the treatments caused any visible effect on the onions and there were no significant differences in yield between any of the treatments and the check. (Dept. of Horticulture, Purdue Univ., Agr. Exp. Station, Lafayette, Indiana.)

Post-emergence control of weeds in snap beans using a shielded boom. Wilson, J. D. and Bruner, H. E. Snap beans were planted in sandy loam May 27. On June 19, the planting was divided into plots 2 rows wide by 100' long and sprayed with formulations of nine different herbicides. The crop was shielded by "U" shaped shields 20" long that traveled over the row. The front of the shield was elevated 1½" while the back equipped with a 6" x 1" skid attached to the outside of the shield, dragged on the ground. A self propelled wheelbarrow carried the equipment and was adjusted to travel at a steady 2 m.p.h. The applications were all made at the rate of 50 gal./acre. The herbicides used and rates per acre were as follows: Dow Selective, 3 gal.; Shell 130, 10 gal.; Endothal 3003, 1 gal.; Sulfasan, 2 gal.; PEC, 2 gal.; ME-3002, 10 lbs.; ME 3001, 10 lbs.; Santobrite, 10 lbs.; and Form A, 10 lbs. At the time of spraying the beans were 10" to 12" tall and there was a complete ground cover of weeds up to 6" tall including red root, purslane, galinsoga, smartweed, lambsquarters, mallow and foxtail. No cultivation was used either before or after spraying. Observations made one week after spraying showed Santobrite and Shell 130 gave good weed control, but were somewhat injurious. Top performance was delivered by Sulfasan followed by Form A and Dow Selective. PEC and the ME's did not give satisfactory weed control. (Ohio Agr. Exp. Sta.)

PROJECT VI--CONTROL OF WOODY PLANTS

L. W. Melander

SUMMARY

It has been demonstrated that many undesirable woody plants can be controlled by hormone-like sprays. The cost is relatively low; consequently, there are now many situations where the control of woody plants with chemicals is a practicable undertaking. The importance of the use of herbicides for killing these plants becomes evident when we consider, among other things, the problem of eradicating alternate hosts of plant diseases, of controlling competitive and light inhibiting plants in reforestation, and of eliminating undesirable woody plants from millions of acres of range and permanent pastures, and rights-of-way. This field is almost unlimited, and American agriculture and industry stand to gain tremendous benefits.

Relatively few woody plants are killed completely with one chemical spray applicati. Complete control requires two or more treatments. In woody plant eradication the objective should be established before operations are started to determine if the project requires complete eradication or merely adequate control. If complete eradication is the objective, much more chemical and more drastic treatment are required. With the eradication of alternate hosts and poisonous plants a complete kill is desirable. However, in most other woody plant situations a complete kill i: not necessary, so the treatment is keyed for a high degree of control. In the latter case, the better the "kill" the longer will be the interval between retreatments, and subsequent cost of maintenance will be greatly reduced.

As more and more research work is done, the selectivity of 2,4-D (2,4-dichlorophenoxyacetic acid) and 2,4,5-T (2,4,5-trichlorophenoxyacetic acid) is becoming more pronounced, and there also is much more good information available on dosages. In many cases it is now being found that heavier dosages will do a better job. This does not imply that the more 2,4-D or 2,4,5-T that you use on sensitive woody plants the better kill you will get, because increasing dosages only gives better kills up to a certain concentration and then no further effect is apparent. Tolerant plants not affected by certain concentrations of 2,4-D or 2,4,5-T cannot be killed by increasing dosages.

It appears that a clearer line of distinction is being made between the "II" and "III" type reactions as defined for the reaction table. Basically, there is a wide difference between these two types. Type "II" denotes that a plant in certain designated stages of growth may be killed by repeated applications of chemical. In contrast, the type "III" reaction implies that a plant is not killed by repeated treatments with a certain chemical formulation. From a chemical-control and management-practice point of view, it is very important that the reaction type resulting from application of different formulations be determined in advance of large-scale operations.

For spraying mixed stands of woody plants, mixtures of 2,4-D and 2,4,5-T are desirable. Chemical manufacturers are doing an excellent job of improving formulations of 2,4-D, 2,4,5-T, and mixtures of the two. Among these improvements are increased toxicity, reduction of volatility, and better solubility.

From reports received oil solutions (Diesel oil mostly as a diluent) are being used more and more as foliage sprays. Increasing the amount of special oils in emulsions for foliage sprays is also being widely tested. For cold weather spraying, oil solutions are the most desirable regardless of whether the whole plant, basal stem, ground line, or cut surface treatments are used.

The effect of penetrants on the toxicity of hormone-like spray formulations has not been widely studied. Such penetrants as pentachlorophenol, turpentine, et al., deserve further consideration.

Up to the present time formulations of 2,4-D and 2,4,5-T have been used principally as foliage sprays. For most species of woody plants the most effective "kill" is obtained when the plants are in the succulent stage. However, some sensitive types are killed when the foliage is sprayed even in the late summer or predormant stages.

Spraying with 2,4-D and 2,4,5-T on a year-round basis probably will become a regularly accepted practice. Native species of barberries now are being sprayed with hormone-type sprays on a year-round schedule. The best kill, regardless of the season, is obtained when the whole barberry plant is covered with the spray. The year-round spray schedule is being worked out for other types of woody plants.

In using 2,4-D and 2,4,5-T formulations as dorment treatments by various methods, studies should be made to determine for different climates if there are periods of dormancy when treatments with oil solutions or other mixtures are ineffective. For a year-round spray treatment program the reaction of plants in different stages of dormancy to chemical sprays should be known.

Basal and ground line treatments with 2,4-D and 2,4,5-T in oil solutions used on dormant shrubs, sprouting stumps, and trees are proving effective. Some oaks and maples, numerous shrubs, and even white ash seem to succumb to this type of winter treatment. Reports of tests using various rates per acre, up to eleven pounds, were received. The results were very encouraging. Spray application equipment should be designed to give a thorough coverage at the base of all plant units. The basal and ground line treatments present a relatively cheap method for killing large shrubs and trees. However, thorough spraying around each plant unit is very important.

In this connection, there is need for research to determine if the chemical is absorbed laterally into the bark and then translocated to the roots, causing the plant to die; or does the chemical penetrate into the soil at the base of the plant and then is absorbed directly by the roots. If the latter is the case, it may be feasible to spray the soil only at the base of plants.

Cut surface treatments with chemicals have a very definite place in woody plant control. They are especially useful in clearing operations, where prevention of sprouting is essential. Mixtures of 2,4-D and 2,4,5-T esters in oil solutions seem to be very effective in most cases. Some seasonal variation in effectiveness was reported.

While this report, so far, has dealt with the hormone-type of chemicals, other herbicides should not be overlooked. For cut surfaces, frills, etc., dry ammonium sulfamate (amate) appears to be the most consistent killer and sprout inhibitor. It also has other specific herbicidal uses as a foliage spray for some types of plants.

Salt, sodium chlorate, borax, polybor chlorate, et al., also have definite places in the herbicidal "tool chest" for certain types of spot and soil sterilization treatments. Trichloracetate also may have a place in woody plant control activities.

There are still many woody plants that present real problems and are not readily killed by chemicals, especially by chemicals of the hormone type. Certain species of oak, maple, ash, hawthorn, elm, roses, buckbrush, and others appear tolerant

to 2,4-D and 2,4,5-T. Previously, others that were considered tolerant to 2,4-D now are killed by 2,4,5-T; i.e., Osage orange and blackberry. With others, differen methods of treatments; i.e., basal stem, etc.,may provide a solution to the problem. Increased dosages within certain limits may help also. It is known that the techniques of application of 2,4-D and 2,4,5-T have not been fully exploited. With the present interest in herbicides, research workers in experiment stations, chemical company laboratories, and other places will continue to evolve new and more effective herbicides. In this connection, the ultimate goal should be a chemical that will be sufficiently toxic to give complete "kill" with one treatment.

The abstracts and the information contained in the plant-reaction table were received from a wide range of territory consisting of numerous States in the United States and from three "member" Provinces in Canada. This year the data concerning the reaction of various woody plants to chemicals are consolidated in one table, regardless of what chemical was used. The 1949 data dealing with the reaction of different woody plants to chemicals is also included in the 1950 table.

New information through research is obtained each year regarding the reaction of woody plants to various chemicals; consequently, cooperators should check over their data annually and submit up-to-date material to the summarizers. This might seem like repetition, but is is surprising how the information changes from year to year.

Acknowledgment is hereby made of the excellent cooperation received from the numerous contributors that made this report possible, and it is hoped that this teamwork will continue from year to year.

Response of woody species to herbicides. Alex, J. F. and R. T. Coupland. The 116 plots of seven woody species treated at two stages in 1949 with two rates of butyl ester of 2,4-D and a mixture of 2,4-D and 2,4,5-T (Weedone Brush Killer 32) were reexamined in 1950 to determine what lasting effects the treatments had on these species. 2,4-D was ineffective on Rosa at both stages and Brush Killer left no effect when applied in the late-bud and early-leaf stage. Brush Killer at 4,000 p.p.m. killed all those plants of Rosa which had been completely covered with spray at the stage of full-leaf development, while Rosa treated at the same date with a 2,000 p.p.m. concentration of the mixture were recovering as shown by sprouts from the base and low on the stem. Both chemicals produced about equal effects on Salix, Symphoricarpos and Ribes. The sprayed stems generally were killed down to within one foot from the ground, but, new shoots usually had arisen from the remaining portions or from their roots and made vigorous growth during 1950. Treatments made during the stage of full-leaf development had the greater effect on these three species. Plots of Populus tremuloides, when treated during full-leaf were controlled to a greater extent than when treated during early succulent growth. Recovery of Populus and Prunus was much slower following treatment with Brush Killer than with 2,4-D alone. Both chemicals appeared to have only a local effect on Populus and Prunus as shown by the healthy extremities of some trees which bore normal green leaves in 1950 while the centers of the crowns remained defoliated. Elaeagnus commutata recovered completely from all treatments in the first stage except the 4,000 p.p.m. concentration of Brush Killer which effected a 50 percent kill. Both chemicals produced nearly complete control of the above-ground parts in the full-leaf stage. However, half of these plots were recovering by sending up new shoots from their roots or the lower parts of the sprayed stems. (Contribution of the Department of Plant Ecology, University of Saskatchewan, Saskatoon, Canada.)

Seasonal effects of esteron Brush Killer on aspen. Arend, John L. and James W. Buerge. To obtain more specific information on the seasonal effects of basal sprays, 10 or more aspen trees (including both P. tremuloides and P. grandidentata) were treated periodically during the dormant season and weekly from May 1 through October with Esteron Brush Killer containing an acid equivalent of 2 pounds per gallon each of 2,4-D and 2,4,5-T. The Esteron Brush Killer was mixed in a 2-percent solution of No. 1 fuel oil on a volume basis. The silvicide was then applied uniformly around the base of the stem to a height of about 4 feet with a low-pressure garden sprayer. The size of the aspen trees treated varied from 1 to 6 inches in diameter. The effects of the repeated treatments have been observed since February through one complete growing season.

No effects were noted on the trees treated during the dormant and early-growing seasons until the foliage was almost fully developed. At this stage, or about June 15, the foliage started dying in the tops of the trees, and within 2 to 3 weeks all previously treated trees appeared dead. For a period of two weeks immediately after full-foliage development, the leaves wilted rapidly after treatment and the tops appeared dead within 1 to 2 weeks. Thereafter, as the growing season progressed, the effects of the treatment showed up more slowly. For example, trees treated in August showed no effects for 2 weeks and required 4 to 6 weeks for a complete top kill. From these first years' observations, it appears that Esteron Brush Killer mixed in a 2-percent solution of fuel oil is very effective in killing the tops of aspen regardless of the season applied. However, for sprouting and suckering effects, the observations must be continued for another growing season. (Contributed by Lake States Forest Experiment Station, Lower Peninsula Branch, East Lansing, Michigan.)

First-year results of six methods used to control scrub oak, aspen, and red maple in northern Michigan. Arend, John L. During 1950 six different methods were tried at four seasons of the year to control scrub oak (Quercus alba, Q. borealis, Q. ellipsoidalis and hybrids), aspen (Populus tremuloides and P. grandidentata) and red maple (Acer rubrum). The methods used were (1) conventional axe method - trees less than 5 inches at d.b.h. were cut, and those larger were girdled, (2) Amate crystals applied to stumps of small trees and in cups at base of larger trees, (3) Esteron 44 in a 2-percent diesel oil solution (volume basis) applied as a basal spray, (4) Esteron 245 in 2 percent diesel oil solution (by volume) applied as a basal spray, (5) Esteron Brush Killer in 2 percent diesel oil solution (by volume) applied as a basal spray, and (6) Esteron Brush Killer in 4 percent diesel oil solution (by volume) applied as a basal spray. These six methods were applied to all trees on half-acre replicated plots at four seasons of the year in a randomized block design. The seasons tested were (1) Winter (February), (2) Spring (May), (3) Summer (July), and (4) Fall (September). Size of trees treated varied from 1 to 10 inches at d.b.h. Number of trees ranged from 500 to 700 per acre. Basal area ranged from 30 to 45 sq. ft. per acre.

In general, the basal sprays were more effective when applied in the spring about the time the buds start to open. Sprouting was very prolific on the cut plots. Trees treated with amate crystals produced weak sprouts, but the aspen did not sprout or sucker the first growing season. None of the trees treated with basal sprays showed evidence of sprouting except for Esteron 44 on red maple. (Contributed by Lake States Forest Experiment Station, East Lansing, Michigan).

Dormant spraying of brush. Bakke, A. L. and D. W. Staniforth. Brush growing in southern Iowa consisting mostly of small hickory trees 2 to 4 inches in diameter was sprayed on April 14, 1950, with the ester formulations of 2,4-D and 2,4,5-T. Concentrations of 10,000 and 20,000 p.p.m. in fuel oil were applied as base (2 feet) and over-all sprays. At the time the leaf buds of the hickory were considerably swollen. On August 24, 1950, the smaller hickory saplings 4 feet in height were killed, oaks 12-15 feet were dead. The over-all applications on hickory, oak, sumac, and buckbrush gave good results. In the case of the higher with concentration, 20,000 p.p.m. of the mixture of 2,4-D and 2,4,5-T equal parts, the results were more marked than with the straight 2,4,5-T. Here, the buds did not develop but dried up. In the latter case the trees might be fully leafed. In early October practically all of the brush sprayed was dead. Along with the defoliation there was a severe cracking of the bark of the hickory through the cambium far into the woody portion of the main stem. Ringing the main stem at different heights above the zone of application did not appear to have any effect. (Contribution Iowa Agricultural Experiment Station).

Dormant season treatments of brush with 2,4-D, 2,4,5-T, and their mixture. Beatty, R. H., Allen, W. W. and Lacko, E. F. Formulations of 2,4-D and 2,4,5-T were applied separately and as mixtures to different woody species during December 1949 and January 1950, along a utility right-of-way in New Jersey, to determine the effectiveness of spraying standing brush during the dormant season. Treatments were made by applying a 1½-percent and 3-percent-acid-equivalent solution (11 and 22 pounds acid equivalent per acre) of the 2,4-D, 2,4,5-T, and mixtures in fuel oil, water, or in a water-oil emulsion around the base of the brush to a height of six inches above the soil line. White ash (Fraxinus americana), oak (Quercus spp.), butternut hickory (Carya cordifornus), hazelnut (Corylus americana), aspen (Populus spp.), birch (Betula spp.) predominated with wild cherry (Prunus spp.) chestnut (Castanea dentata), sassafras, hickory (Carya spp.), sourgum (Nyssa sylvatica) dogwood (Cornus spp.), elm (Ulnus spp.), maple (Acer spp.), and tulip tree

(Liriodendron tulipifera) scattered throughout. Complete results cannot be ascertained from one summer's observations, but certain results are apparent. Apparent kills ranged from 50 percent to 96 percent. The 1½ percent concentration, approximately 11 pounds acid equivalent per acre, of the butoxy ethanol esters of 2,4-D, and 2,4,5-T in fuel oil killed species as oak, chestnut, and aspen, with the exception of ash. The ash did not make new growth.but kept some leaves all summer. Red maple was killed by all mixtures at lowest concentration. In general, higher concentration was no more effective on ash. The ester of 2,4,5-T at 1½ percent concentration in oil-water mixture, 10 gallons fuel oil, and 90 gallons water, showed indication of being as effective as straight oil. Unsatisfactory results were obtained with mixtures of 2,4-D-2,4,5-T and 2,4,5-T alone at both concentrations in water. Plots will be observed for another two-year period to determine lasting effects of treatments. (Contribution of Agricultural Chemical Division, American Chemical Paint Company, Ambler, Pennsylvania).

Willow spraying during the dormant season. Butler, C. C. During the 1949-1950 fall, winter, and spring seasons, dormant willows were sprayed with the butyl-ester formulation of 2,4-D and diesel oil, with the objectives of determining the most effective date of application, volume of oil, rate of 2,4-D, and the portion of cane where the treatment is most effective. Five pounds of acid equivalent in 40 gallons of oil per acre were used in the date-of-application study. The resulting kill of canes was 100 percent for those sprayed in November, 97 percent in December, 93 percent in January, 37 percent in February, 97 percent in March, and 77 percent in April. Growth from lateral root-stocks during the following growing season followed the same trend, ranging from 7 percent in November to 70 percent in February. Five pounds of acid equivalent mixed with 5, 10, 20, 40, 80, 160, and 320 gallons of oil per acre were used to study a most effective volume of oil. Below 40 gallons per acre regrowth ranged from 40 to 45 percent. Where 40 gallons per acre or more were applied, regrowth ranged from 20 to 25 percent. Five pounds of acid equivalent mixed with 40 gallons of oil applied to the upper one-half, the lower one-half, a 6-inch band at the base on one side of the tree, and a 6-inch band at the base on all sides of the tree made up the study of most effective portion to be sprayed. Regrowth amounted to 3 percent for the lower one-half, 4 percent for the 6-inch band on all sides, 12 percent for the 6-inch band on one side, and 48 percent for the top one-half. Rates of 3, 5, and 10 pounds of acid equivalent mixed with 40 gallons of oil applied in the fall and spring comprised the study of the most effective rate of 2,4-D. Three pounds of 2,4-D resulted in kills of 60 percent, while 5 and 10 pounds were equally effective with a 90 to 95 percent kill. (Contributed by Bureau of Reclamation, Region 6, Billings, Montana).

Experiments with different esters of 2,4-D, 2,4,5-T, and brush killers in water, oils, and emulsions for control of woody growth. Corns, W. G. Experiment I: Wild roses with snowberry at full-leaf stage, June 9, mist-sprayed with paint gun with 2,4-D low volatility ester (Dow H1010), 2,4-D ester (Naugatuck), 2,4,5-T low volatility ester (Dow,)and 2,4,5-T ester (Naugatuck). Rates were 2 and 4 pounds acid equivalent per acre sprayed with 75 gallons water, or 4 or 8 gallons acre of each of 3 "Imperial" oils of low (15 percent), intermediate, and high aromatics (76 percent) content. Experiment II: Wild roses with snowberry sprayed June 13 with Brush Killer low volatility esters of 2,4-D, 2,4,5-T (Dow), and with Brush-Bane (Naugatuck) at 2 and 4 pounds acid equivalent per acre in 75 gallons water or in 4 or 8 gallons acre of each oil, emulsified to 75 gallons with water and Dreft. Experiment III: Wild roses with snowberry sprayed August 11 with above esters of 2,4-D, 2,4,5-T at 8, 16, 24 oz. acid equivalent per acre in water or in 10 gallons of oil per acre (3 oils). Experiment IV: Aspen popler third year regrowth 4-6'

tall on cleared power line sprayed June 15 with above esters of 2,4-D and 2,4,5-T at 2 and 4 pounds acid in 75 gallons water or in 10 gallons oil (3 oils) per acre. Results Experiment I: Both rates, both 2,4,5-T's, caused complete top kill roses and 60-90 percent snowberry depending on rate. Low volatility 2,4-D as effective as 2,4,5-T on roses, but other 2,4-D almost totally ineffective. Both 2,4-D's about same as 2,4,5-T's on snowberry. Regrowth starting at close of season. Low gallonage oil as effective as, but no better than, high gallonage water. Experiment II: Similar to Experiment I. Emulsion not better than water alone or oil alone as carrier, indication somewhat inferior on snowberry. Experiment III: Difference between low volume 2,4-D and other one re roses as in Experiment I, but rates too low (60-80 percent damage to roses) slight damage to snowberry. Oils, however, showed more leaf burning than where water was carrier. Experiment IV: Both rates all chemicals in oils or in water caused 85-100 percent top kill. Incipient regrowth apparent in September. (Contribution Department of Plant Science, University of Alberta, Alberta, Canada).

Comparisons of 2,4-D, 2,4,5-T, and MCP esters on oak, hawthorn, and maple. Coulter, L. L. Basal applications to sprouts of several species of oak were made in February 1950 using concentrations of 4, 8, 16, and 32 pounds acid equivalent of MCP, 2,4-D and 2,4,5-T as the propylene and polypropylene glycol butyl ether ester in 100 gallons of No. 2 fuel oil. MCP gave 3.5, 5.4, 6.9, and 15.9 percent control at the respective concentrations, while 2,4-D gave 29.5, 6.0, 20.0, and 74.6 percent control at the same concentrations. 2,4,5-T gave 11.5, 48.0, 89.5, and 85.3 percent control. Similar treatment of hawthorn bushes 4-8 feet high using a concentration of 10 pounds acid equivalent in 100 gallons killed 88.8 percent of the bushes to the ground, where MCP was used, while 2,4-D and 2,4,5-T each gave 100 percent top kill. By October 1950, some underground buds had become active in both 2,4-D and MCP treatments, while this activity is not evident in 2,4,5-T treatments. Foliage applications made on silver maple (Acer saccharinum) in July 1949 using the same esters in emulsions at a concentration of 2½ pounds acid equivalent in 100 gallons of water produced only stunting and some proliferation of the terminal growth with MCP or 2,4-D, while 2,4,5-T killed all of the plants treated. (Contribution from The Dow Chemical Company, South Haven, Michigan).

Air-blast sprayer performance for applying herbicides on oaks.[1/] Cox, Maurice B. and McDow, John J.[2/] A study of machine performance of an air-blast sprayer was begun June 6 and 7, 1950, with the application of material on 40 plots of oak brush and trees. The sprayer was a John Bean No. 7, Mist-Duster and the herbicide was ACP-BK64, applied at a constant rate of 3 pounds per acre. The blower was operated at a constant speed which delivered 10,5000 cubic feet of air per minute at a velocity of 13,200 feet per minute (150 mph). The variables were carrier volume, type of nozzle, position of nozzle, and pressure. The carrier was Texaco diesel oil and was applied at rates of 5, 10, 15, and 20 gallons per acre. Different sizes of hollow cone and solid cone nozzles were used to obtain the desired rate of application. Each nozzle was directed into and with the air stream, and operated at 100 and 200 pounds per square inch. Satisfactory foliage penetration was obtained up to 45 feet when using 10 or more gallons of carrier per acre. However, final evaluations will not be made until next year.

1/ Contribution of Oklahoma Agricultural Experiment Station and U. S. Soil Conservation Service.

2/ Agricultural Engineer, Guthrie, Oklahoma, and Instructor, Stillwater, Oklahoma, respectively.

Control of huisache (Acacia farnesiana) with basal and cut-surface treatments. Darrow, Robert A. Basal and cut-surface treatments of huisache offer promising methods of control of this small tree which is usually scattered or in localized areas in Gulf Coast pastures of Texas. Monthly treatments with kerosene and diesel fuel poured around the trunk bases have given complete control regardless of season. Cut-surface application of diesel fuel at monthly intervals was effective in mid-winter and in early summer. Basal and stump-surfece treatments with diesel oil containing 1 percent acid equivalent of 2,4,5-T isopropyl ester gave excellent control in monthly applications made from April to September. (Contribution by the Texas Agricultural Experiment Station, College Station, Texas).

Effectiveness of 2,4,5-T on prickly pear (Opuntia lindheimeri). Darrow, Robert A. 2,4,5-T esters appear to give satisfactory control of Lindheimer prickly pear in the Rio Grande Plain of Texas when applied as a drenching spray in oil or oil emulsions. Complete eradication of plants up to 4 feet in height and 6 to 8 feet in diameter has been obtained with 0.5 percent acid concentration of butyl and isopropyl esters in oil solutions. Increased dosages or repeated applications are necessary for larger plants. There is some indication that emulsions containing 25-50 percent diesel fuel were nearly as effective as oil solutions. 2,4,5-T amines were less effective than esters when applied in 50 percent emulsions, although the addition of dinitro compounds increased their effectivity. Mixtures of low-volatile esters of 2,4-D and 2,4,5-T were less effective than the same esters of 2,4,5-T alone. Tests of combinations of 2,4,5-T amines and esters with the sodium salt of TCA in oil emulsions indicated that the substitution of TCA in the spray solution could be made up to 1/3 of the concentration of 2,4,5-T without materially reducing effectiveness. (Contribution of the Texas Agricultural Experiment Station, College Station, Texas).

Foliage spray applications on blackbrush (Acacia amentacea). Darrow, Robert A. Foliage spray applications of 2,4,5-T esters and amines, and combinations of 2,4-D and 2,4,5-T esters in oil solutions and emulsions have given generally unsatisfactory results on blackbrush. Applications of one-half to 1½ pounds acid equivalent per acre were made with ground equipment using 5 and 11 gallons of spray per acre. Diesel fuel appeared to be more effective as a carrier than emulsions containing 25 percent diesel fuel. No consistent differences in top kill were noted among comparable tests of the isopropyl, butoxy ethanol, and propylene glycol butyl ether esters of 2,4,5-T. The amines of 2,4,5-T and combinations of 2,4-D and 2,4,5-T esters were somewhat less effective than the esters of 2,4,5-T. (Contribution of Texas Agricultural Experiment Station, College Station, Texas).

Effects of foliage, basal, and cut-surface treatments of post and blackjack oaks. Darrow, Robert A. Low-volume spray applications averaging 5 gallons per acre of 2,4-D esters and amines, 2,4,5-T esters and amines, and combinations of 2,4-D and 2,4,5-T esters in dosages up to 1½ lbs. per acre failed to give satisfactory top kills on post and blackjack oak regrowth 6 to 8 feet in height. Spray applications were made from a 12-foot horizontal boom from an average height of 8-10 feet. Spring foliage spray treatments were more effective than June or August applications. Effective control in dormant season basal treatments on trees up to 3-4 inches in diameter was obtained with diesel fuel solution containing 2 percent acid equivalent of 2,4-D isopropyl ester. 2,4,5-T amine in emulsions containing 25 percent oil was unsatisfactory for basal treatment. In basal treatments conducted during the spring effective control was obtained with 2 percent acid concentrations of 2,4,5-T esters or 3 percent of 2,4-D and 2,4,5-T esters in combination. Cut surface treatments were effective in dormant seasons and early spring with isopropyl ester of 2,4,5-T and combinations of 2,4-D and 2,4,5-T esters

at 1.2-1.5 percent acid concentrations. Dormant season cut-surface treatments with 2,4-D esters in oil solutions gave results comparable to 2,4,5-T isopropyl ester. (Contributed by the Texas Agricultural Experiment Station, College Station, Texas).

Basal-stem sprays effective on alder and red maple. Day, Maurice W. Alder (Alnus incana) and red maple (Acer rubrum) up to 4 inches in diameter were treated with several solutions of 2,4-D and 2,4,5-T in Diesel oil. The sprays were applied to the ground line up to about 4 feet in sufficient quantity to thoroughly wet the bark. A stand containing 3,360 stems per acre (.6 inches in diameter and larger) required 60 gallons of solution per acre. The 2,4,5-T esters in Diesel oil at 5,000 p.p.m. resulted in 90 percent to 100 percent kills of both species. Concentrations of 8,000 p.p.m. were 100 percent effective and higher concentrations appeared to have no value. The 2,4-D esters in Diesel oil were not as effective at the same concentrations as the 2,4,5-T. However, at 20,000 p.p.m. the 2,4-D gave a 100 percent kill. Treatments made in February, March, June, and August appeared to give equal control except that the summer treatments secured better coverage. Basal-stem sprays appear to offer much promise as a means of controlling these species. (Contribution of the Michigan Agricultural Experiment Station-Dunbar Forest Experiment Station).

The use of sprayer equipment in stands of alder. Day, Maurice W. Dense stands of alder (Alnus incana) present a difficult problem when attempting to apply basal sprays. A trial of a tractor and sprayer combination in such a stand was made at the Dunbar Forest Experiment Station. A Hardie #99X sprayer mounted on rubber tires was pulled by a Caterpillar R2 tractor. The tractor driver also operated the spray gun and applied the solution as the tractor proceeded through the stand. Using this method and equipment it was possible to spray one acre in two hours using 60 gallons per acre. The stand treated was 73 percent alder and was composed of 3,360 stems per acre, .6 inches in diameter and larger. The equipment proved satisfactory for this use but some minor changes were indicated. The sprayer itself will require a guard over the pump and engine and also a stronger hose connection at the pump. A spray gun suitable for use in one hand would also be desirable. No attempt was made to try out different pressures, but a pressure of about 100 psi seemed to be satisfactory. (Contribution of Michigan Agricultural Experiment Station-Dunbar Forest Experiment Station).

Effect of 2,4-D and 2,4,5-T on oaks when used as basal and frill sprays. Elder, W. C. and J. E. Gassaway. The trees used in this test were post oak (Quercus stellata) and blackjack (Quercus marilandica). Trees under 4" in diameter were treated from the ground line up to 1 foot on the tree trunk, while larger trees were frilled with axe gashes around the base of the tree and the spray applied only in the gashes. Treatments were started in July 1949, and have been made at monthly intervals since that date. 2,4,5-T and 2,4-D, individually and in combination, were used at different concentrations in Diesel oil and kerosene. Concentrations were calculated on weight basis. For example: 1 gallon of 2,4,5-T containing 4 pounds acid would be mixed with 91 pounds of oil to make a 4 percent concentration. Concentrations from 1 percent to 5 percent were used for the treatments. The amount of basal spray used for treatments was estimated to be 20 cc to 30 cc for each tree 2" to 3" in diameter. For frills 20 cc to 30 cc were used for trees 5" to 6" in diameter. 2,4,5-T gave a better kill than 2,4-D in all applications. 2 percent 2,4,5-T was superior to 1 percent 2,4,5-T + 2 percent 2,4-D. The 2,4-D compared more favorably with 2,4,5-T when used in frills. All frilled trees appeared dead where concentrations above 2 percent 2,4,5-T were used from August to April and where 1 percent 2,4,5-T + 2 percent 2,4-D were used in the same months. The best results from basal treatments were observed in December and March treatments. Heavy concentrations of 2,4,5-T gave fair results in January and February. Very little

injury appeared when basal sprays were used from May through August. Post oak was easier to kill than blackjack. Frilled trees caused quicker top kill than basal treated trees. Most trees receiving basal treatment in the dormant stage leafed out early in the spring, but the leaves died back during the spring and summer months on the more affected plots and appeared pale and withered on some of the less affected ones. In most plots some sprouting has appeared at the base and under the trees. (Contribution of the Agronomy Department, College of Agriculture, Stillwater, Oklahoma.)

Effect of 2,4-D and 2,4,5-T on persimmon trees. Elder, W. C. and Gassaway, J. E. Concentrations of 2,4-D ester and 2,4,5-T ester, each ranging from 1/2 percent to 5 percent, were used separately and in combination to test their reaction on persimmon (Diospyros virginiana L.). Kerosene and Diesel oil were used as carriers. Applications were made with a knapsack sprayer treating the trees as follows: 5 cc to 15 cc of liquid on trees 1/2" to 2" in diameter applied to lower 12" of the tree as a basal spray; 5 cc to 10 cc in shallow axe gashes (frills) cut 1" above ground line on trees 2" to 4" in diameter; and 5 cc to 8 cc on stumps 1/2" to 2" in diameter cut near the ground line. Treatments were started in August 1949 and monthly treatments have been duplicated since that date. Observations made in the summer of 1950 show 5 percent 2,4,5-T provided 100 percent top kill and allowed very little resprouting when applied in December as a basal spray. The same treatment applied from January to April permitted more sprouting, becoming more severe as the treatments moved into the spring months. Sprouting was more evident when weaker concentrations of 2,4,5-T were used. 2,4-D appeared relatively ineffective on persimmon when applied as a basal spray even in concentrations up to 5 percent. Where applications of 2½ percent 2,4-D + 2½ percent 2,4,5-T were made on the frilled persimmon from August to February, total top kill has been obtained and no sprouting from base of the tree is evident. Treatments following February allowed sprouts to appear. None of the stump treatments were completely effective in eliminating sprouts, but 2½ percent 2,4-D + 2½ percent 2,4,5-T was most effective. Poor results were obtained in the fall months, good control was obtained in January with only a few sprouts appearing, and the sprouting becoming more severe as the treatments went into the spring months. There were no differences observed between Diesel oil and kerosene used as a carrier. (Contribution of the Agronomy Department, College of Agriculture, Stillwater, Oklahoma).

Effectiveness of 2,4,5-T and 2,4-D as a dormant and foliage spray with airplanes on oak brush. Elwell, Harry W. and Elder, W. C. The treated area was predominately post oak and blackjack ranging in size from sprouts to trees 20 feet tall and 6 to 8 inches in diameter. The dormant spray was applied March 29, 1950, just as the buds were enlarging. Where 2 to 3 pounds of 2,4,5-T or 2,4-D in mixtures was used in 5 gallons of oil per acre, the leaf appearance was delayed 30 to 40 days. Many of the terminal twigs were killed. However, heavy growth of new sprouts and leaves was present by mid-summer and still green in the fall months. Early observations showed coarse particles more effective than mist sprays of oil. Also, the Pratt's oil was superior to Diesel oil. Three pounds 2,4,5-T per acre was much more effective than 1 pound 2,4,5-T + 2 lbs. 2,4-D. The foliage spray was made June 20, 1950, when the trees had full-leaf growth. It is too early to comment on the foliage tests except to give observations on leaf injury. Two pounds of 2,4,5-T in 5 gallons of Diesel oil caused more damage to the leaf than 4 pounds of 2,4-D ester in the same amount of oil. Ester of 2,4,5-T was more effective than amine 2,4,5-T when each was used in 1-gallon soffoil + 4 gallons water per acre. Injury was similar in plots where 2 pounds of 2,4,5-T was used in 10 gallons of oil per acre compared with 4 pounds of 2,4,5-T + 5 gallons of oil per acre. On some plots leaves have dropped or dried up on the trees sufficiently to allow sunshine to

enter and encourage native grass development. However, new growth has appeared on the larger branches and much underbrush and sprouts are growing. (Contribution of Soil Conservation Research and Agronomy Department, College of Agriculture, Stillwater, Oklahoma).

Selective herbicides controlled oak brush for grass production.1/ Elwell, Harry M. 2/ The chemical used was 2,4-D. The formulations were sodium and ammonium salts, amine and esters of both butyl and isopropyl. They were applied to oak brush in May at the rate of 3 pounds per acre in sufficient water to permit good wetting of the leaves. The first application killed a high percentage of the plants. But a few plants were either missed or resistant to the chemical. Therefore, they were treated again the second year with about 1 pound of acid per acre. The ammonium salts and esters controlled the brush. But heavy root sprouting occurred where the other materials were used. Native grass developed soon after the shade from the brush was removed. It produced 3,000 pounds of hay per acre the second year after treatment. And, the third year this area produced 66 pounds of beef per acre during summer grazing.

1/ Contribution from Oklahoma Agricultural Experiment Station and U. S. Soil Conservation Service, Research. Abstracted from paper in Agronomy Journal, Vol. 42, No. 8, August 1950, and Oklahoma Agricultural Experiment Station Mimeographed Circular M-192. 2/ Soil Conservationist, Red Plains Conservation Experiment Station, Guthrie, Oklahoma.

Sweet fern control with herbicides. Engle, L. G. and J. W. Buerge. Sweet fern (Comptonia peregrima) occupies large areas of land in the Lake States where pine plantations are being established. This shrub not only competes with the young pine but is the alternate host of the Saratoga spittle bug (Aphrophera saratogensis) which attacks red pine. Sweet fern eradication on planting sites is, therefore, desirable.

To obtain preliminary information on the effects of three different promising herbicides on sweet fern, nine 1/40-acre plots were sprayed with three different dosages on August 3, 1950. The herbicides tested were Esteron 44, Esteron 245, and Esteron Brush Killer in two percent water solutions by volume. The dosages tested were 188 gallons, 94 gallons , and 47 gallons of solution per acre (acid equivalents of 15, 7.5, and 3.75 pounds per acre).

The minimum dosage of each formulation gave an apparently satisfactory top kill of the sweet fern. By the end of September, only a few of the lower leaves of the plants remained alive. Observations will be continued another growing season to check the permanency of the first year's effect. (Contributed by Lake States Forest Experiment Station, Lower Peninsula Branch, East Lansing, Michigan).

Control of mesquite with 2,4,5-T and other growth-regulator herbicides applied by airplane. Fisher, C. E. and Dale W. Young. Mesquite has been effectively and economically controlled by airplane application of 2,4,5-T experimentally under favorable conditions. A 98 percent top kill with 69 percent of the plants showing no regrowth 14 months after treatment was obtained in tests made in 1949. The most desirable season for treatment was during the first heavy foliage stage in the spring. This occurred 6 to 8 weeks after the first leaves appeared, when mesquite was actively growing with ample soil moisture and high temperatures. Applications before the first heavy foliage stage, or those made in the summer, fall, or when soil moisture limited growth were less effective or resulted in failures. Rates of 2/3 pound of 2,4,5-T acid per acre consistently gave more effective kills than lesser amounts and were equally as effective as greater amounts, even under less favorable conditions. Low volatile esters of 2,4,5-T appear most desirable

for control of mesquite because of the general proximity of hazard crops in the mesquite belt. The amines of 2,4,5-T also appear promising under ideal conditions. Maximum control was obtained with 2/3 pounds of 2,4,5-T in 4 gallons per acre of an oil-water emulsion containing 25 percent diesel oil. Other carriers tried have generally been less effective and frequently more costly. Formulations of 2,4-D and mixtures of 2,4-D and 2,4,5-T gave erratic and generally ineffective control of mesquite. Proper airplane application of herbicides has given more effective control of mesquite at lower cost than any ground equipment tested. (Contributed by the Texas Agricultural Experiment Station and the U. S. Bureau of Plant Industry, Soils and Agricultural Engineering, Spur, Texas).

Effect of herbicides on woody plants. Friesen, H. A. The amine and ester of 2,4-D, an ester of 2,4,5-T, and a low volatile ester of 2,4-D were each applied at three rates, viz: 1/2, 1, and 2 pounds of acid equivalent per acre. Furthermore, the esters of 2,4-D and 2,4,5-T were mixed in the ratios of 1:1, 1:2, and 2:1; the mixtures were then applied at 1/2, 1, and 2 pounds of total acid equivalent per acre. A contact weed killer at 3 pounds and an acetanalide of 2,4-D at 1 pound of active ingredient per acre were also applied. Water at 80 gallons per acre was used as diluent. The treated brush consisted of a mixed population of Western snowberry (Symphorocarpus occidentalis), silver willow (Eleagnus commutata), and rose brush (Rosa spp.) Snowberry was the predominant species. Moisture conditions were excellent.

Each treatment at each rate of application resulted in essentially complete defoliation of each species. The contact weed killer and the amine of 2,4-D gave the poorest brush kills. Regrowth began appearing within one month after treatment. The ester, the low volatile ester and the acetanalide of 2,4-D had only a very slight regrowth of rose bush and snowberry six weeks after treatment. The ester of 2,4-D and the ester of 2,4,5-T mixed in the ratios of 1:1 and 2:1, respectively, and applied at 2 pounds of total acid equivalent per acre gave the best kills. There was essentially no regrowth on these plots at the time of our first fall frost, which occurred in late August some 3 months after treatment. (Contributed by the Dominion Experimental Station, Scott, Saskatchewan).

The use of TCA to eradicate prickly pear cactus. Hamilton, Roger D. Two treatments, using 4 percent and 9 percent solution of TCA were applied on prickly pear cactus on August 29, 1949. One-third to one-half pint of the solution was applied to each clump of cactus. Sixty and 80 percent, respectively, eradication was obtained. The nine months following the treatment were dry and the effects of the chemical still could be observed on these clumps where regrowth occurred in August 1950. (Contribution of the Amarillo Conservation Experiment Station, Amarillo, Texas).

The effect of sodium trichloroacetate on the germination and survival of red pine seedlings. Hansen, Henry L. and Karl A. Loerch. In an attempt to determine the possibilities of TCA for use in controlling quack and other grass weeds in forest nurseries, a series of tests was made to determine the tolerance of red pine seeds and seedlings to this chemical. Replicated tests in three different soil types were made covering the following: 1. TCA applied at the rates of 50, 75, and 100 pounds per acre at the time of emergence of the red pine seedlings; 2. TCA applied at the rates of 50, 75, and 100 pounds per acre approximately three months before germination; 3. TCA applied at the rates of 25, 37½, and 50 pounds per acre six weeks before transplanting young red pine seedlings into the soil. The following results were obtained: 1. Applications at the rate of 50, 75, and 100 pounds of TCA made at the time of germination of the red pine seedlings resulted in

extremely heavy mortality; 2. the mortality was a result of killing the seedlings after they emerged from the seed rather than a reduction of seed viability; 3. TCA applied at the rate of 50 pounds per acre to three different soil types three months before seed germination did not injure the young seedlings. Heavier applications were injurious; and 4. rates of application as low as 25 pounds per acre applied 6 weeks before transplanting young red pine seedlings into the soil resulted in heavy mortality. (Paper No. 729 of the Miscellaneous Journal Series of the Minnesota Agricultural Experiment Station, St. Paul, Minnesota).

Effects of various foliage sprays on quaking aspen (Populus tremuloides) at the Quetico-Superior Wilderness Research Center. Hansen, Henry L., and Clifford E. Ahlgren. During the summer of 1949 a number of test sprayings were made on 2-year-old aspen sucker stands at Basswood Lake, Minnesota. These young trees averaged from two feet to eight feet in height, and were given a foliage spray by means of a back pack pump using a fine nozzle. The following spray formulations were used: 2,4-D isopropyl ester 1,500 p.p.m., 2,4,5-T isopropyl ester 3,000 p.p.m., and 50-50 combination of the two preceding formulations, 3,000 p.p.m. After two growing seasons the following conclusions seem to be warranted for the conditions tested: (1) Early season spraying was definitely more effective than either midseason or late season spraying as of the end of the second growing season. It is probable, however, that most of the stems listed as injured will die and that the ultimate effectiveness of the three spraying seasons tested will be about the same; (2) No consistent differences in effectiveness were apparent between the three sprays tested, although the best single treatment was 2,4-D at 1,500 p.p.m. sprayed on June 18; and (3) The presence of patches of blackened cambium on the stems was found to be a result of spraying peculiar to aspen and not noted on any other species sprayed. (Paper No. 723 of the Miscellaneous Journal Series of the Minnesota Agricultural Experiment Station, St. Paul, Minnesota).

Effects of various foliage sprays on beaked hazel (Corylus cornuta) at the Quetico-Superior Wilderness Research Center. Hansen, Henry L., and Clifford E. Ahlgren. During the summer of 1949 test spraying was done using three different formulations in early season, midseason, and late season on the foliage of beaked hazel at Basswood Lake, Minnesota. The following table summarizes the results of these tests.

Spraying Date	Nature of Spray Used: Chemical	Conc. (ppm)	Stems Killed (percent)
June 18, 1949	2,4-D isopropyl ester	1500	91
June 18. 1949	2,4,5-T isopropyl ester	3000	91
June 18, 1949	50-50 combination of above	3000	100
July 29, 1949	2,4-D isopropyl ester	1500	90
July 29, 1949	2,4,5-T isopropyl ester	3000	92
July 29, 1949	50-50 combination of above	3000	100
August 31, 1949	2,4-D isopropyl ester	1500	61
August 31, 1949	2,4,5-T isopropyl ester	3000	34
August 31, 1949	50-50 combination of above	3000	31

The following conclusions seem to be warranted for the conditions tested: (1) June and July spraying were definitely more effective than those made in late August; (2) No consistent differences in the effectiveness of the three formulations were noted; (3) A very satisfactory kill (90 percent or more) was obtained on the sprayed stems of this species for all tests except those made in late August. (Paper No. 712 of the Miscellaneous Journal Series of the Minnesota Agricultural Experiment Station, St. Paul, Minnesota).

Effects of various foliage sprays on mountain maple (Acer spicatum) at Quetico-Superior Wilderness Research Center. Hansen, Henry L. and Clifford E. Ahlgren. During the summer of 1949 a number of spray tests were made on mountain maple at Basswood Lake, Minnesota. These were foliage sprays using three formulations of spray material. Spraying was done in the early summer, midsummer, and late summer using a back pack pump and a fine nozzle spray. Results of these tests are summerized in the following table:

Date Sprayed	Nature of Spray Used: Chemical	Conc. (ppm)	Stems Killed (percent)
June 18, 1949	2,4-D isopropyl ester	1500	7
June 18, 1949	2,4,5-T isopropyl ester	3000	36
June 18, 1949	50-50 combination of above	3000	28
July 29, 1949	2,4-D isopropyl ester	1500	13
July 29, 1949	2,4,5-T isopropyl ester	3000	25
July 29, 1949	50-50 combination of above	3000	12
August 31, 1949	2,4-D isopropyl ester	1500	18
August 31, 1949	2,4,5-T isopropyl ester	3000	4
August 31, 1949	50-50 combination of above	3000	6

The following conclusions seem to be warranted for the conditions tested: (1) None of the spray materials tested gave a satisfactory kill of this species; (2) The most effective kill (only 36 percent) was obtained by using 2,4,5-T at 3,000 p.p.m. in the early season spray. (Paper No. 722 of the Miscellaneous Journal Series of the Minnesota Agricultural Experiment Station, St. Paul, Minnesota).

Control of brambles and brush with mixtures of 2,4-D and 2,4,5-T. Josephson, L. M. Effective kill of brambles, brush, and woody type plants was obtained with mixtures of 2,4-D and 2,4,5-T when sprayed in September. Materials containing one-fourth and one-half of 2,4,5-T and the remainder isopropyl ester of 2,4-D and applied at the rate of 4 pounds of acid per acre gave complete kill of blackberry canes while smaller amounts of 2,4,5-T gave only partial killing. Very small amounts of 2,4,5-T and 2,4-D alone killed the leaves of blackberry but apparently had no effect on the woody portions of the plants. Rapid killing of the leaves was obtained with 2,4,5-T alone but apparently too rapid kill was obtained for the material to enter the plants. Wild cherry, hawthorns and other hardy shrubs showed leaf killing with all formulations but permanent kill was not obtained. Plants more resistant to 2,4-D, such as poison ivy and lamb's quarters, were readily killed with mixtures containing 2,4,5-T. (Contributed by Kentucky Agricultural Experiment Sta.)

Effects of 2,4-D on solid stands of Western snowberry (Symphoricarpos occidentalis). Kilcher, Mark R. Tests were made with 2,4-D ester with both oil and water base at the rate of 2 pounds per acre in June 1947 and again in June 1948. It should be pointed out that the tests were conducted on solid stands on sites ecologically adapted to the species and that few other species were growing naturally in the association. Under these conditions the results have been disappointing, the top growth killing back temporarily but a very vigorous regrowth from the roots. (Contribution from Dominion Experimental Station, Swift Current, Saskatchewan).

Effects of 2,4-D on rose bushes and silverberry (Elaeagnus commutata). Kilcher, Mark R. A stand of mixed Rosa and Elaeagnus was sprayed with 2,4-D ester, at the rate of two pounds per acre with both oil and water base. The Elaeagnus was completely killed, but the Rosa was not affected. The reduced competition, however, provided better conditions for the growth of Rosa which then over-ran the entire area. (Contribution from Dominion Experimental Station, Swift Current, Sask.)

Basal trunk treatments of cottonwood trees. Klingman, D. L., N. E. Shafer, and J. D. Furrer. Of four trees basally sprayed with 5 percent solution of each treatment June 19, 1950, the following results were observed September 13, 1950. 2,4-D ester in Diesel oil, 4 (6-9") were dead; 2,4,5-T ester in Diesel oil, 4 (7-11½") were dead; 2,4-D amine in water, none dead (4½-10"); 2,4,5-T amine in water, none dead (5-8"). Figures in parenthesis indicate the range in diameter of the trees treated. Trees treated with 2½ percent 2,4,5-T ester plus 2½ percent 2,4-D ester solution gave results as follows: The combination esters in Diesel oil gave 4 (5-7") dead trees; the same combination in water killed no trees (3-8"). In this test the Diesel oil was definitely superior to water as a carrier, making the difference between success and failure. The 2,4-D and 2,4,5-T were equally effective at the rates used. (Contribution of the Nebraska Agricultural Experiment Station and the Division of Weed Investigations, B.P.I.S.A.E. cooperating).

Buckbrush (Symphoricarpos occidentalis) control by chemicals. Klingman, Dayton L. 2,4-D reduced the stands of buckbrush by approximately 60 percent on plots treated for two seasons (1948 and 1949) at one and two pounds per acre of an ester formulation, when applied in either June or July. In this experiment there was little difference between the rates of treatment or between the dates of treatment. 2,4,5-T ester applied at the same dates and rates gave but 20 percent or less reduction in stand. Plots within this same experiment were given initial treatment of 2,4-D in June 1949, (one season only) gave approximately 20 percent reduction which is considerably poorer results than obtained in other experiments by a single season of treatment. In another experiment, but within 100 feet of the above, were a series of plots initially treated May 15, 1949, in which stand reductions with an ester exceeded 75 percent. The above indicates a seasonal variation in results to be expected and a need for more detailed studies on effects of dates of application for effective control. (Contribution of the Division of Weed Investigations, B.P.I.S.A.E. and the Nebraska Agricultural Experiment Station, cooperating).

Cut surface treatments of Osage orange with 2,4-D and 2,4,5-T. Klingman, Dayton L. Osage orange cut stumps were sprayed with 5 percent solutions of 2,4-D, 2,4,5-T in Diesel oil, and 2,4-D plus 2,4,5-T at 2½ percent each in Diesel oil February 27, 1950. Trees had been cut 8 to 14 inches from the ground from one to two months prior to treatment. Stumps varied in size from 3 to 10" in diameter. Of 13 stumps sprayed with 2,4-D, all produced vigorous sprouts; of 14 stumps sprayed with 2,4,5-T, 13 stumps were dead September 26, 1950; and of 15 sprayed with 2,4-D plus 2,4,5-T, all were dead. (Contribution of the Division of Weed Investigations, B.P.I.S.A.E. in cooperation with Nebraska Agricultural Experiment Station).

Chemical weed control in forest firelanes. Kuntz, J. E., Riker, A. J., and Thomas, J. E. Weed growth in forest firelanes and access roads greatly increases the chances of fires crossing such barriers. Weed control by mechanical means (plowing, disking, scraping, or rototilling) has certain limitations. Some possibilities of chemical weed control were explored with firelanes in central Wisconsin. Applications of common herbicides were made in August 1948, December 1949, and April 1950, at recommended rates to replicated plots one square rod in area. Weed populations included quack, witch, foxtail, and crab grasses; sedge; and chickweed, spurge, pepper grass, bindweed, sheep sorrel, lamb's quarters, Euphorbia sp., and ragweed. These weeds are characteristic of the highly leached, rapidly drying, and infertile Plainfield sand sites. Original weed stands and regrowth were both more abundant on the rototilled than on the non-rototilled firelanes. Spring applications gave much better weed control than fall treatments. Applied in the spring, Borascu (10 pounds and 20 pounds per square rod, dry), concentrated borax (10 pounds per square rod, dry), and a mixture of 2,4-D (isopropyl ester, 5 pounds and 10 pounds per

acre, spray), and TCA (ammonium and sodium salts, 25 pounds and 50 pounds per acre, spray) all have given encouraging control (less than 5 percent of check) for at least one season. Polybor chlorate (5 pounds and 10 pounds per square rod, dry) did almost as well. Ammonium sulfamate (320 pounds per acre, spray) and sodium chlorate (2 pounds and 4 pounds per square rod, dry) gave good initial control, but by midseason regrowth occurred. Chlorosol-A (80 pounds per acre, spray), calcium chloride (12 pounds per square rod, dry), sodium chloride (16 pounds per square rod, dry) and PCP (sodium salt, 20 pounds per acre, spray) gave little or no promise. For a time in the sodium chloride plots and throughout the season in all borax plots, deer "rooting" was conspicuous. (Contribution of the Wisconsin Agricultural Experiment Station in cooperation with the Wisconsin Conservation Department and the Nekoosa-Edwards Paper Company).

The translocation of poisons between oak trees through natural root grafts. Kuntz, J. E. and Riker, A. J. The movement of chemical herbicides within and between plants affects the eradication of deep rooted species. In experiments to prevent tree-to-tree spread of the oak wilt disease, oak trees were heavily treated with sodium arsenite (61.5 percent solution), Amate (dry), sodium chlorate (dry), Borascu (dry), and 2,4,5-T (isopropyl ester, 40 percent solution). Unmeasured quantities of the respective poison were carefully applied in small holes either in the buttress roots or in the root collar region. In the case of sodium arsenite, Amate, and sodium chlorate, not only were the treated trees rapidly killed, but also several adjacent untreated trees. During six weeks, 2,4,5-T showed little effect on the treated trees and neither 2,4,5-T nor Borascu showed any translocation to other trees. The greatest distance of translocation and the maximum number of nearby trees involved per treated tree were as follows: sodium arsenite, 45 feet and 7 trees; Amate, 25 feet and 3 trees; sodium chlorate, 20 feet and 2 trees. Among more than 300 trees poisoned, only one case of translocation between oak species has been found. Especially with sodium arsenite, translocation within and between trees was traced easily by the distinct, dark brown discoloration of the inner bark and outer sapwood. Downward movement of sodium arsenite into the roots appeared to be limited except where roots were grafted onto those of other trees. Washing and digging out of tree root systems revealed extensive and widespread natural grafting of oak roots. (Contribution of the Wisconsin Agricultural Experiment Station in cooperation with the Wisconsin Conservation Department and the Nekoosa-Edwards Paper Company).

Chemical control of weed competition in forest plantations. Kuntz, J. E. and Riker, A. J. The survival and subsequent growth of young forest plantations are severely limited by weed competition--especially grass--during the first year or two. Weed control by mechanical methods has certain limitations. The possibilities of chemical weed control in plantings of cottonwood cuttings were tested in replicated plots on Miami silt loam in southern Wisconsin and on Plainfield sand in central Wisconsin. Herbicides were applied in the early spring to circular areas 27 inches in diameter around dormant cuttings recently planted in a 5' x 5' spacing in both plowed and unplowed plots. The exposed part of the cutting was protected during treatment. In unplowed, unweeded check plots, tree survival was less than 10 percent and growth was less than 6 inches. With clean cultivation over the entire area on plowed plots, survival was more than 80 percent and growth was over 5 feet high. On plowed plots where weed control, either by hand cultivation or by certain chemicals, was limited to the small areas, tree growth was reduced to approximately one-half of that on clean cultivated check plots. A mixture of 2,4-D (isopropyl ester, 5 pounds per acre, spray) and TCA (ammonium and sodium salts, 25 pounds per acre, spray) gave excellent weed control with no apparent injury to the trees. TCA alone (25 and 50 pounds per acre), a mixture of 2,4-D and IPC (emulsifiable oil, 16 pounds per acre) and a mixture of 2,4-D and Chlorosol-A (80 pounds per

acre) performed almost as well. While sodium chlorate (2 pounds and 4 pounds per square rod, dry), polybor chlorate (5 pounds per square rod, dry), and ammonium sulfamate (320 pounds per acre, spray) gave good weed control, unfortunately all injured or killed the trees. 2,4-D and 2,4,5-T alone (5 pounds per acre, spray), calcium cyanamide (500 pounds and 1,000 pounds per acre, dry), and PCP (sodium salt, 20 pounds per acre, spray) gave little or no promise. (Contribution of the Wisconsin Agricultural Experiment Station in cooperation with the Wisconsin Conservation Department and the Nekoosa-Edwards Paper Company).

Response of woody vegetation to dormant and foliage sprays of 2,4-D and 2,4,5-T. Lee, Oliver C. Mixed woody vegetation growing in a fence row and along a ditch bank was sprayed with 2,4,5-T, polypropylene glycol butyl ether ester of 2,4-D and a "brush killer," (2,4-D and 2,4,5-T combination). Replicated plots were sprayed during the months of January, February, March, April, May, June, and August 1950 to determine the effect of time of application. All materials were applied in fuel oil, dilution 1 pound of acid per 20 gallons of oil. Spray was applied in sufficient quantity to assure contact with all plants. Vegetation consisted principally of wild cherry, alderberry, willow, oak, maple, and hickory sprouts and sumac, poison ivy and wild grape. Observations made on October 20, 1950, indicated that 2,4,5-T is more effective as a woody plant killer than 2,4-D or the combination of 2,4-D and 2,4,5-T. Applications of 2,4,5-T applied during January, February, and March prohibited leaf formation of all species sprayed. Although roots have not been completely destroyed, no new growth has appeared on plots sprayed with 2,4,5-T. Dormant spraying appeared to be equally as effective as foliage sprays. Such species as wild grape, poison ivy, and willows were destroyed by the other two materials used. (Contribution of Agricultural Experiment Station, Purdue University).

The effect of two 2,4-dichlorophenoxyacetic acid formulations sprayed on Western snowberry (Symphoricarpos occidentalis) in pasture using 3 different rates. Leggett, H. W. The two formulations used were the triethanolamine and butyl ester, and the rates were 1, 1.5, and 2 pounds of 2,4-D acid per acre. The plots were sprayed on June 24, 1950, when growth conditions were good and the plants were in the pre-bud stage of growth. The amine plots at 1, 1.5, and 2 pounds of 2,4-D acid per acre gave percentage top-growth kills of 25, 30, and 37 percent, respectively. The ester plots at the same rates gave percentage top-growth kills of 47, 73, and 92 percent, respectively. Readings on a similar set of plots sprayed on June 21, 1949, gave some interesting data this year. The plots sprayed with the ester formulation at rates of 1, 1.5, and 2 pounds of 2,4-D acid per acre showed the following percentages of regrowth in 1950: 25, 10, and 5 percent, respectively. The plots sprayed with similar rates of the amine formulation showed the following percentages of regrowth: 75, 45, and 25 percent. The foregoing is practically a repeat of results obtained in 1949 from our 1948 sprayings. Good control of Western snowberry is thus obtained by spraying with the ester formulation at rates of 1.5 and 2 pounds of 2,4-D acid per acre, when sprayed at the pre-bud stage of growth. (Contribution of the Dominion Experimental Station, Lacombe, Alberta).

The effect of 2,4-D and 2,4,5-T treatments applied during the dormant season to buckbrush, (Symphoricarpos orbiculatus.) McCall, G. L., and J. W. Zahnley. When 2,4-D or 2,4,5-T were applied as a basal dormant treatment to certain species of trees, results were very encouraging. Because of this, solutions of 2,4-D as the isopropyl and "Lorol" esters and 2,4,5-T as the propylene glycol butyl ether ester were applied to dormant buckbrush in Diesel fuel at a concentration of 2 percent.

The solutions were applied at the rate of approximately 40 gallons per acre during the last week of February 1950. When the plots were examined the following August,

results were quite poor. The 2,4-D formulations had defoliated the buckbrush from 40 to 50 percent while 2,4,5-T gave an average defoliation of only 30 percent. Some twigs and small branches were killed back to the main stems which as a general rule were unaffected.

Dormant treatments of buckbrush with esters of 2,4-D and 2,4,5-T in oil appear to be more expensive and less effective than do similar treatments applied while the plant is in full leaf and actively growing. (Contribution of the Kansas Agricultural Experiment Station, Manhattan, Kansas).

Dormant season and spring treatment of elm and hackberry stumps. McCall, G.L. and J. W. Zahnley. A mixture of elm and hackberry stumps ranging in size from 1-6 inches in diameter were treated by using a paint brush to apply the various 2,4-D and 2,4,5-T formulations to the cut surface immediately after the trees were felled. Treatments were applied March 31, 1950, while the trees were still in the dormant stage. Concentrations used were 2, 4, and 8 percent of acid (weight to volume) in the carrier. Data indicate that 2,4-D is equal to or better than 2,4,5-T in preventing resprouting, that the dimethylamine salt of 2,4-D in water is equal to the 2,4-D esters in kerosene in preventing resprouting, and that the addition of an emulsifiable oil to the amine water formulations reduces their efficiency.

Amate solutions up to concentrations of 3 pounds per gallon of water did not give satisfactory control of elm or hackberry when the stumps were painted. When the cut stumps were treated with the dry crystals of amate, resprouting was effectively controlled. (Contribution of Kansas Agricultural Experiment Station, Manhattan, Kansas).

The response of green ash (Fraxinus lanceolata) to dormant season applications of 2,4-D and 2,4,5-T. McCall, G. L., and J. W. Zahnley. Green ash, Fraxinus lanceolata, is one of the species most difficult to kill with foliage sprays of 2,4-D, 2,4,5-T, or their mixtures. Consequently, basal applications were made during the dormant season to uncut trees and to resprouts from trees cut two or three years previously. Solutions of 2,4-D were used at concentrations of 2 and 8 percent (weight to volume) as the isopropyl ester in Diesel fuel and 2,4,5-T was used at concentrations of 1, 2, 4, and 8 percent as the butyl ester in the same solvent. Trunks of the test plants were sprayed to a height of approximately 12 inches on February 3, 1950, using an atomizing nozzle.

An examination of the treated plots in the fall of 1950 indicated that all treatments killed the large ash trees (3 inches and greater in diameter) but that in each treatment some resprouts from the cut trees had not been killed. Data indicate that either 2,4-D or 2,4,5-T can be used to kill green ash if they are applied as basal dormant sprays. They also indicate the desirability of treating the ash trees before they are cut down instead of relying on treatments of resprouts. Final readings of plots will be taken in 1951. (Contribution of the Kansas Agricultural Experiment Station, Manhattan, Kansas).

White brush control. McCully, Wayne G. White brush (Aloysia ligustrina) forms dense impenetrable thickets on medium-textured bottomland soils in southwest Texas. This species is similar to mesquite and certain other woody plants in its development of a zone of dormant buds at the base of the main stem. Tests using a hand sprayer on individual plants and with ground equipment on small plots show a positive reaction to ester and amine formulations of 2,4-D, to combinations of 2,4-D and 2,4,5-T acids, amines and esters, and to 2,4,5-T amines applied as foliage sprays. A good rate of physiological activity, a condition existing immediately

following each rain of any consequence during the summer, is essential for translocation of the herbicide within the plant. An oil spray containing 6,000 p.p.m. of 2,4-D ester applied to freshly cut stumps was effective in preventing sprouting. Oil solutions of 2,4,5-T ester and oil emulsions containing 2 pounds of amate per gallon were fairly effective as stump treatments. (Contributed by Texas Agricultural Experiment Station, College Station, Texas).

Stump treatments of post oak using amate. McCully, Wayne G. Amate was applied to freshly-cut stumps of post oak and at two intervals of sprout growth from both treated and untreated stumps at the rates of 1½ and 3 pounds per gallon water and in 4 percent and 10 percent oil emulsion. A commercial soluble oil was used in the emulsions. Stump treatments made in January were generally ineffective. Subsequent treatment of sprouts in June and late October did not increase the effectiveness of the initial treatment. Portions of some plots were burned early the following spring and the sprout height on the burned portion was materially less than on the unburned. (Contributed by Texas Agricultural Experiment Station, College Station, Texas).

Macartney rose control. McCully, Wayne G. Large clumps of Macartney rose (Rosa bracteata) were sprayed two successive years in late summer with 2,000 and 4,000 p.p.m. of 2,4,5-T ester in water and in a 5 percent oil emulsion. The higher concentration of 2,4,5-T applied in the emulsion resulted in less resprouting than in the water solution or either type spray mixture with certain penetrants added. Mid-summer applications of various herbicides to low-growing plants resulting from continuous mowing for several years were made with ground equipment using 20 gallons of spray material per acre. A 90-percent top kill was obtained with 2/3 pounds of 2,4-D low volatile ester. Most of the plants resprouted from the base. Good top kills were also obtained using 2,4-D and 2,4,5-T esters in combination and with 2,4,5-T ester. Very little effect was registered by 2,4,5-T amines up to 1¼ pounds per acre applied in water and as emulsions. Materials applied in a 25 percent Diesel emulsion showed an advantage over water sprays. Application of boron at rates up to 15 pounds per 100 square feet in circular bands around the plant was unsatisfactory in treating standing plants and in preventing resprouting of plants cut off at ground level. (Contributed by Texas Agricultural Experiment Station, College Station, Texas).

Comparison of effects of formulations of 2,4-D and 2,4,5-T on Allegheny barberry. Melander, L. W. and Wm. M. Watson. During the seasons 1946, 1947, 1948, and 1949, over one thousand one-quarter-square-rod plots of Allegheny barberry (Berberis canadensis) were treated with all available formulations of 2,4-D (2,4-Dichlorophenoxyacetic acid) at different seasonal stages of growth. In 1948 and 1949 several formulations of 2,4,5-T also were tested. Concentrations ranging from 1,000 to 2,000 p.p.m. were used. The inconsistent results obtained in treating Allegheny barberry with 2,4-D show that this chemical is not effective when used alone. On the other hand, a mixture of 2,4-D with 2,4,5-T used in oil solution produced good results. A concentration of 1 percent, or 10,000 p.p.m., of a two-to-one mixture of 2,4-D and 2,4,5-T in an oil solution with pentachlorophenol added as a penetrant now is being used on a filed basis and is giving assatisfactory kill. (Contribution of Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, U.S.D.A.)

The effect of adding penetrants to formulations of 2,4-D and 2,4,5-T in killing Allegheny barberry. Melander, L. W., and Wm. M. Watson. Two penetrants, pentachlorophenol and turpentine, were added to oil spray solutions of 2,4-D and 2,4,5-T and applied to Allegheny barberries (Berberis canadensis) in the dormant [illegible] stage. Neither of these penetrants had any significant herbicidal effect on this

barberry, but because of their apparent ability to facilitate penetration of the herbicide, they did increase the percentage of kill when mixed with formulations of 2,4,5-T. Allegheny barberry is semi-tolerant to 2,4-D formulations, and penetrants did not increase their toxicity. When added to formulations of 2,4,5-T, pentachlorophenol proved superior in effectiveness to turpentine. From the results obtained, it would appear advantageous to add pentachlorophenol to 2,4,5-T formulations for killing Allegheny barberry. (Contribution of Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, U.S.D.A.)

Comparative effect of sodium chlorate and sodium chlorate borax on Allegheny barberry. Melander, L. W., and Wm. M. Watson. During the past season several tests were made by treating one-quarter-square-rod plots of Allegheny barberry (Berberis canadensis) with sodium chlorate (Atlacide) and sodium chlorate-borax (Polybor Chlorate). From two to eight pounds per square rod were applied. Pound for pound, polybor chlorate seems to kill Allegheny barberry as well as Atlacide. In the tests made, eight pounds per square rod are the most effective dosages with both chemicals. (Contribution of Bureau of Entomology & Plant Quarantine, Agricultural Research Administration, U.S.D.A.)

Year-Round sprays for killing native Allegheny barberries. Melander, L. W., and Wm. M. Watson. The Allegheny barberry (Berberis canadensis) is now being killed at all seasons of the year with formulations of 2,4-D and 2,4,5-T. Spraying the dormant bushes with 1½ percent of a two-to-one mixture of 2,4-D and 2,4,5-T plus a penetrant in Dieselene gave 95 percent top kill and complete kill of 80 percent of the plants. A 1-percent solution of the same mixture used when the plants were in leaf gave equally effective results, as indicated by observations made four months after treatment. The whole plant is covered with chemical, regardless of the season. Neither the penetrant nor the diluent was effective when used alone. The year-round treatment is considered highly effective and practical for initial eradication work. (Contribution of Bureau of Entomology & Plant Quarantine, Agricultural Research Administration, U.S.D.A.)

Year-round sprays for killing native Colorado barberries. Melander, L. W., and E. A. Lungren. The Colorado barberry (Berberis fendleri) is now being killed at all seasons of the year with formulations of 2,4-D and 2,4,5-T. An emulsion containing 2,000 p.p.m. of 2,4-D ester is used for the summer foliage spray, and a 1½ percent oil solution of a two-to-one mixture of 2,4-D and 2,4,5-T plus a penetrant is used as a dormant spray in the fall, winter, and spring. The whole plant is sprayed regardless of the season. These chemicals give practically a 100 percent top kill, and less than 5 percent of the plants sprout when either the foliage or the dormant spray is used. (Contribution of Bureau of Entomology & Plant Quarantine, Agricultural Research Administration, U.S.D.A.)

Killing ribes with 2,4-D and 2,4,5-T. Offord, H. R., Moss, V. D., and Quick, C. R. In California a series of defoliation tests were started to measure the effect of repeated low dosages of systemic defoliants (chiefly 2,4-D) for Ribes suppression. The purpose of these tests was to determine the practicability of low-cost broadcast spraying of forest land by methods designed to achieve suppression of Ribes over a period of 5 years or more, rather than in one or two high-cost treatments. One spraying with 50 parts per million of 2,4-D acid caused complete defoliation and significant damage to mature R. roezli. Results of 1949 basal-stem treatments of Ribes were better than results achieved to date with foliage sprays. Five percent of 2,4-D or 2,4,5-T (or 2.5 percent of each) in Diesel oil, fuel oil, kerosene oil, or stove oil applied only to the basal stems of intact Ribes in amounts sufficient to wet the stems killed 90 percent or more of the treated plants.

For the period of the tests (April to October) the stage of plant growth did not affect bush kill in this basal-stem treatment. In north Idaho tests (crew methods and equipment) showed that brush and Ribes could be sprayed broadcast most rapidly (0.7 man-day per acre) by power sprayers equipped with the pecan-type orchard gun. The axial-flow power blower was used effectively to kill Ribes and brush along roadsides by applying 1 percent solutions of 2,4,5-T ester (1 percent summer oil added) in two runs from opposing directions. The fishtail nozzle was used for work within 15 feet of the machine and the oval nozzle for getting distribution and good coverage out to a distance of about one chain (66 feet). (Contribution of the Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, U.S. Department of Agriculture, Berkeley, California).

Spraying and fogging Ribes by helicopter with 2,4-D and 2,4,5-T. Offord, H.R., H. R. Moss, V. D., and Quick, C. R. A 10 percent check of 12 two-acre plots on Ribes viscosissimum and R. lacustre in north Idaho sprayed in June 1949 showed that 1 pound per acre of 2,4,5-T acid (as isopropyl ester) in 10 gallons of diluent (10 percent summer oil emulsion) was the most economical and effective treatment. Dosages of 1, 2, and 3 pounds per acre of 2,4,5-T acid in 5 and 10 gallons per acre of diluent (Diesel oil and aqueous summer oil) were compared. In 1950 about 1,500 acres in northern Idaho and western Montana were sprayed with 2,4,5-T (1) to kill brush and associated Ribes, (2) to desiccate Ribes and brush as a pre-treatment for controlled burning, (3) to suppress brush as a competitor of white pine and ponderosa pine in plantations. One area of 280 acres was burned over August 31 and another of 200 acres on September 15, with excellent results. In May 1950 preliminary tests were made in California of a thermal fogging device, installed in a helicopter, for applying low dosages of 2,4-D to Ribes and white pine. The low-vapor-pressure ester of 2,4-D (butoxyethanol) was applied at calculated dosages of 3, 6, 9, and 12 ounces acid per acre to potted Ribes and white pines. The purpose was to determine effects of low dosages of 2,4-D designed to produce a systemic defoliation of Ribes without damaging pines. Six ounces of the acid per acre showed close to 100 percent defoliation of Ribes in open, light, and medium brush cover, without significant damage to pines. Brush cover providing more than 50 percent shade seemed to protect the potted Ribes from the full effects of the herbicidal fog. (Contribution from Bureau of Entomology and Plant Quarantine. Agricultural Research Administration, U. S. Department of Agriculture, Berkeley, Calif.)

Effect of time of foliage spraying with 2,4-D and 2,4,5-T on initial kill of hazel. Roe, Eugene I. Thirtieth-acre plots of hazel brush (Corylus americana and C. cornuta; density, 49,000 stems per acre; height, 6 to 8 feet) in a medium stocked stand of mature red pine on the Chippewa National Forest, Minnesota, were sprayed with the new low volatile butyl esters (Dow) of 2,4-D, 2,4,5-T, and a 50-50 percent mixture of these, all in water solution. These were applied in concentrations of 2,400 and 4,800 p.p.m. to separate plots at fortnightly intervals from June 21 to August 28, 1950. The solutions were applied by means of D. B. Smith E-Z knapsack sprayers using Bete-P-40 fog nozzles. As a result of the fine dispersion, excellent coverage was obtained with amounts of solution ranging from 44 to 60 gallons per acre. Using the amount of kill in early September (late August treatment omitted) as a criterion, one time of summer spraying was practically as good as another, all giving 90 to 100 percent kill of the hazel. Resprouting has been negligible on all plots except those sprayed in mid-June and some sprayed in early July. Doubling the strength of the herbicides shows no consistent results thus far. 2,4,5-T, both separately and in combination with 2,4-D, is apparently no more effective on hazel than 2,4-D alone. (Contribution of Lake States Forest Experiment Station, Grand Rapids, Minnesota).

Resistance of bog shrubs to foliage spraying with 2.4-D and 2.4,5-T. Roe, Eugene I. Small plots of Labrador tea, leatherleaf, swamp laurel, and other shrubs located in a non-forested swamp near Cohasset, Minnesota, were sprayed with the low volatile butyl esters (Dow) of 2,4-D and 2,4,5-T and a 50-50 percent mixture of these, all in water solution. Concentrations used were 4,800, 9,600, 19,200, and 38,400 p.p.m. The spraying was done on July 21, 1950, using D. B. Smith knapsack sprayers with Bete P-40 fog nozzles. Approximately 115 gallons of solution were used per acre as the sphagnum moss was also sprayed. Stem counts made in early September show that the best initial kill of Labrador tea (54 percent) was obtained with the strongest concentration of 2,4-D; results with both 2,4,5-T and this chemical in combination with 2,4-D were much poorer. The other evergreen shrubs, leatherleaf and swamp laurel, are much less resistant to the herbicides although both species required at least 19,200 p.p.m. for heavy kill. The common blueberry showed heavy to complete kill from 9,600 p.p.m. and up of both herbicides, singly and in combination, but appears to be more sensitive to 2,4,5-T. Sphagnum moss as shown earlier (Roe, 1949 Report p.154) was readily killed by all concentrations of the herbicides. (Contribution of Lake Forest Experiment Station, Grand Rapids, Minnesota).

Scrub oak control in Wisconsin with ammonium sulfamate. Stoeckeler, J. H.[1/] In June 1949, an experiment was initiated near Port Edwards, Wisconsin, in cooperation with Nekoosa-Edwards Paper Company, on control of scrub oak (Quercus ellipsoidalis). Scrub oak in this area is considered as a weed species. It has little or no commercial value and competes strongly for growing space with the more valuable jack pine (Pinus banksiana) which is suitable for pulpwood.

The trees to be eliminated were frilled with axe cuts made at 6-inch intervals on the circumference of the tree and near its base. Treated trees had an extreme range of 1 to 15 inches in diameter at breast height, most of them being from 3 to 8 inches in diameter. A tablespoon of amate crystals were placed in each frill.

Counts made in June 1950 showed a 73.7 percent complete kill without resprouting. An additional 9.3 percent of the trees were 90 percent or more defoliated. Cost of the operation, including labor at $1.21 per hour and the chemical at 16¢ per pound, was $2.49 per 100 trees treated. Growth rate of understory jack pine was 50 percent greater in treated than in untreated plots. This occurred as a result of allowing more sunlight to reach the pine and reduced root competition in plots where scrub oak had been largely eliminated.

1/ Forester, Lake States Forest Experiment Station, St. Paul, Minnesota.

Control of brush in demonstration plots. Sylwester, E. P. and Hoffmann, O.L. Demonstration plots of mixed brush were sprayed with ester mixtures of 2,4-D and 2,4,5-T in 50-50 proportion. A concentration of 2 pounds per acre was used throughout. Sprayings were made in spring and summer, and stump treatments were made in winter and summer. Observations on effectiveness of treatments were recorded in "Table of Reactions for Woody Plants." (Contributed by Iowa State College).

2,4-D and 2,4,5-T as basal sprays on Osage orange. Woestemeyer, V. W. Duplicate plots of old Osage orange regrowth ranging to ten feet in height were sprayed around the base of the trees from ground level to a height of 18 inches February 20, 1950. Temperature was 32°F. Each plot consisted of five or more trees. Treatments were 2,500, 5,000, 10,000, and 20,000 p.p.m. of 2,4,5-T ester in No. 2 Diesel fuel; 5,000 p.p.m. 2,4-D ester plus 5,000 p.p.m. 2,4,5-T ester in Diesel fuel; 5,000 p.p.m. 2,4-D ester in Diesel fuel; and 5,000 p.p.m. 2,4,5-T ester in water. Application was made to the point of runoff with a flat fan nozzle and 40 pounds pressure. Of the 2,4,5-T treatments in oil, no plots leafed out during the season

except those sprayed with 2,500 p.p.m. and these were completely defoliated by mid-summer. Resprouting occurred at the base of most of the trees receiving 2,500 p.p.m, while the heavier treatments resulted in one sprout each on the 5,000 and 20,000 p.p.m. plots and none on the 10,000 p.p.m. plot. The mixture of 2,4,5-T and 2,4-D did not leaf out and had no resprouts. Both plots sprayed with 5,000 p.p.m. 2,4-D in oil came into full leaf. One lost its leaves by mid-summer and had one resprout by fall, while the other showed some effect of 2,4-D in the leaves, but they made nearly normal growth throughout the season. The plots sprayed with 5,000 p.p.m. 2,4,5-T in water appeared normal until mid-summer when one plot lost a few of the lower leaves but otherwise showed no effects. (Contribution of Kansas Agricultural Experiment Station.)

Effect of 2,4-D, 2,4,5-T, and mixtures of these on woody growth. Wood, H.E., Bourns, J. J., Shanks, G. L., Playfair, L. G., Sharpe, R. N., and Fuller, J. C. E. Field trials were continued during 1950, similar in pattern to those reported in 1949, except that in one series a single large capacity nozzle (Boomjet) was used; in the other series a turbine sprayer. Nine different products, all esters, were used at rates from 16 to 48 ounces acid per acre in from 10 to 40 imperial gallons water; on one plot, 5 gallons oil. Growth on most plots was moderately dense, ranging from about 2 feet for roses, to as high as 20 feet for some of the oak and poplar. The following species were present in approximately the same proportions--perhaps rather less hawthorn: bur oak (Quercus macrocarpa), white poplar (Populus tremuloides), willow (Salix spp.), hawthorn (Crataegus spp.), hazel (Corylus spp.), rose (Rosa spp.). Treatments were made June 13on one series, and the 29th on the other, well after leafing was completed. The following general conclusions were agreed upon by a number of those interested in the project, after checking throughout the season: (1) Apart from roses, which were resistant to 2,4-D, all six species were about equally affected--control being rated from 80 percent to 93 percent; (2) There was very little advantage in kill obtained by increasing the volume of water from 10 to 40 gallons; and (3) The turbine gave penetration to a depth of 30 feet or more, with more satisfactory coverage than the single nozzle which reached in width not more than 10 feet. (Contribution of the Weeds Commission, Manitoba Department of Agriculture, co-operating with the Highways Branch, and the Manitoba Power Commission, Winnipeg, Canada).

Treatments to mesquite with ground equipment. Young, Dale W., and C. E. Fisher. The most effective control of mesquite with ground equipment may be obtained by removing the top wood and spraying the stumps and cut surfaces thoroughly with a solution of 1 pound of 2,4,5-T ester in 20 gallons of Diesel oil or kerosene. Small trees and sprout growth over 3 feet high may be controlled by spraying with 2,4,5-T during the full leaf stage in the spring of the year. One pound of 2,4,5-T, either ester or amine, should be mixed with enough water or oil to thoroughly cover an acre of brush. Under ideal conditions water is equal to oil as a carrier. Under less favorable conditions oil is the most effective carrier. If mesquite cannot be sprayed during the full leaf stage, because of the nearness of susceptible crops, a basal treatment may be used. Excellent top kill and some root kills have been obtained by spraying the lower branches and trunk thoroughly with one pound of 2,4,5-T ester in 20 gallons of Diesel oil. As in the cut surface method, best results occur during the summer. However, treatments may be made at other seasons with some reduced effectiveness. (Contributed by the U. S. Bureau of Plant Industry, Soils, and Agricultural Engineering and the Texas Agricultural Experiment Station, Spur, Texas).

Chaparral control. Young, Dale W., and C. E. Fisher. Chaparral (Condalia obtusifolia) is a dense thorny shrub that sprouts vigorously from the roots when mechanical control is attempted. This invader often seriously infests rangeland when mesquite is removed mechanically. Chaparral can be controlled for several years by thoroughly spraying the plant with an emulsion of a mixture of the esters of 2,4-D and 2,4,5-T or the amine or ester of 2,4,5-T at concentrations of one percent during the active-growing stage. A one-percent solution of a combination of the esters of 2,4-D and 2,4,5-T or the ester of 2,4,5-T in oil is an effective spray at any time of the year. These esters in oil are very effective on cut surfaces of chaparral. Because of the dense nature of the plant, high pressures and moderately high volumes of herbicides are needed for best results. (Contributed by the U. S. Bureau of Plant Industry, Soils, and Agricultural Engineering, and the Texas Agricultural Experiment Station, Spur, Texas).

Response of horse chestnut or buckeye (Aesculus glabra sargentii) to 2,4-D, 2,4,5-T, and amate. Zahnley, J. W. and G. L. McCall. Several cases of cattle being poisoned by eating the opening leaves of buckeye were reported in Kansas last spring. Since little information is available concerning control of the species involved, experiments with herbicides were started. Amate and different formulations of 2,4-D and 2,4,5-T were applied as a spray to the new growth early in May. Young plants 1 to 5 feet high were sprayed to wet all the foliage to the point of runoff. Amate at 1/2 and 1 pound per gallon of water failed to give a satisfactory kill, although the 1 pound rate killed the stem to within 1 inch of the ground. The triethanol amine salt of 2,4,5-T in water, 1,000 and 2,000 p.p.m. caused a slow loss of foliage but the stems remained green, while 4,000 p.p.m. gave complete kill and roots were so rotted by fall that the plants could be easily lifted out of the ground. Diethanolamine salt of 2,4-D, 2,000 p.p.m. killed only the top two-thirds of the stem, the lower portion remaining green, while 2,000 p.p.m. isopropyl ester killed the plants completely and the roots were partially decayed by fall. Amate crystals on the cut surface of the stumps resulted in complete kill. (Contribution of the Kansas Agricultural Experiment Station, Manhattan, Kansas.)

Response of persimmon (Diospyros virginiana) and certain other species of trees to 2,4-D and 2,4,5-T applied as basal sprays. Zahnley, J. W. and G. L. McCall. Solutions of 2, 4, and 8 percent 2,4-D and 4 and 8 percent 2,4,5-T on an acid basis in Diesel fuel were applied to the lower 15 inches of the trunk or dormant trees early in March. All were young trees ranging from less than 1 inch to 3 inches in diameter. Applications of 4 and 8 percent on an acid basis of the esters of 2,4,5-T apparently resulted in complete kill of persimmon, i.e., no basal sprouts had appeared at the end of the first season. Scattered plants of bur oak, black walnut, mulberry, hackberry, elm, apple, peach, and elder were killed by either 2,4-D or 2,4,5-T. Blackberry plants were killed by the esters of 2,4,5-T and the butoxy ethanol ester of 2,4-D. However, wild dewberry treated with a 4 percent solution of 2,4,5-T which appeared dead until mid-summer showed 15 percent resprouting by late October. Gooseberry was killed by 4 percent 2,4,5-T. Amate crystals applied to the cut stumps of persimmon killed the stump but numerous root sprouts came up a few inches to 2 feet away from the stump. (Contribution of the Kansas Agricultural Experiment Station, Manhattan, Kansas.)

Effect of 2,4-D, 2,4,5-T, mixtures of the two, and amate on stumps and sprouts of Osage hedge. Zahnley, J. W. and G. L. McCall. Osage hedge trees 3 to 5 inches in diameter were cut 12 to 15 inches above ground and painted a few hours after cutting with the pure ester of 2,4-D and 2,4,5-T, with equal parts of the two, and with a 10 percent solution of these esters in Diesel fuel. Amate, 5 pounds to 1 gallon of water as a spray and amate crystals applied dry also were used. Treatments

were made July 1, 1949. Results recorded September 19, 1949, and November 1, 1950. are essentially the same. Resprouting occurred on all plots where 2,4-D only was used. Growth on the plots treated with 10 percent ester of 2,4-D in Diesel fuel was vigorous, with sprouts 6 feet high on November 1, 1950. No resprouts appeared on the plots treated with 2,4,5-T or 2,4,5-T in mixture with 2,4-D. All stumps sprayed with amate in water produced resprouts, but 50 percent of the stumps treated with dry amate crystals were killed. Foliage treatments of sprouts were less effective than stump treatments. Sprouts 2 to 5 feet high arising from roots left in the soil after hedge trees were removed by a bulldozer were sprayed July 13, 1949, and additional plots were sprayed on August 22 of that year using 1,500, 3,000, and 6,000 p.p.m. of 2,4-D or 2,4,5-T on an acid basis. Sprouts treated with 2,4-D were not seriously damaged while those treated with 2,4,5-T or mixture of 2,4-D and 2,4,5-T were killed to the ground. Resprouting appeared on all plots in 1950, but the growth was greatly inhibited, particularly on plots treated with 2,4,5-T. (Contribution of the Kansas Agricultural Experiment Station, Manhattan, Kansas).

Dormant treatments for the control of black-jack oak[1]. Elwell, H. M. and G. L. McCall [2]. Basal treatments on the black-jack-white oak complex were made on the Red Plains Conservation Experiment Station at Guthrie, Oklahoma, on January 4, 1950, and March 21, 1950, by spraying the lower twelve inches of saplings two to five inches in diameter. The cover was approximately ninety percent white oak and ten percent black-jack. Both esters and amines of 2,4-D and 2.4,5-T and their mixtures were applied in water, oil, and water-oil emulsions.

January applications of the amines of 2,4-D and 2,4,5-T in water containing eight percent acid (weight to volume) gave as good control of oak as any other treatment. In addition they were more effective at preventing resprouting than were other treatments.

Amines applied in January were more effective than those applied in March, while the exact reverse was true of the esters. Esters applied in March were superior to amines applied at the same time. The addition of an emulsible oil to water solutions of 2,4-D or 2,4,5-T amine reduced their effectiveness while the use of water as a carrier for the esters of 2,4-D or 2,4,5-T had the same effect. A mixture of three parts 2,4-D plus one part 2,4,5-T was as good as any of the combinations containing a higher proportion of 2,4,5-T.

[1] Contribution from Oklahoma A. and M. College and Soil Conservation Service, Research.

[2] Soil Conservationist, Guthrie, Oklahoma and Biologist, Manhattan, Kansas, respectively.

Reaction of different woody species to 2,4-D and 2,4,5-T used separately or in combination at different rates, 1950. Pavlychenko, Thomas K. In this project 32 woody species around Saskatoon and in various districts of Saskatchewan were treated in full foliage with ACP 912 (esters of para. 2,4-D and 2,4,5-T), ACP 572 (esters of 2,4-D and 2.4,5-T in oil), Weedone Brush Killer 32 (2,4-D and 2,4,5-T, 2:1), ACP 926 (acids of 2,4-D and 2,4,5-T), ACP 904 (ester of MCP), Dow Brush Killer (butyl ester of 2,4-D and 2,4,5-T). Rates of 1 to 6 pounds per acre were generally applied. Limitations in time and assistance, however, did not permit to use all the rates on all the 32 species treated. RESULTS: The plots were kept under close observation during the entire growing season. In the Fall, final readings were taken and the species placed into their respective reaction groups. The space will not permit to specify to which particular chemical and rate each species gave reaction, I, II, or III; yet it is of importance to know that in this

project the 32 species, subjected to 170 different treatments, gave reaction I in 111 of them; reaction II in 56 and reaction III in only 3 cases. Of the 32 species treated, caragana alone did not give reaction I to any of the chemicals used, irrespective of rates. Reaction II was the strongest effect observed on this species. These results should be regarded as preliminary and the records in 1951 will verify or correct the readings of the first season. (Contributed by Agricultural Division, American Chemical Paint Company, Saskatoon, Saskatchewan).

SUMMARY TABLE

REACTIONS OF WOODY PLANTS TO FORMULATIONS OF VARIOUS CHEMICALS

The data tabulated on the following pages have been submitted by investigators from the United States and Canada and have been assembled by L. W. Melander, Pathologist, Division of Plant Disease Control, Bureau of Entomology & Plant Quarantine, U. S. Department of Agriculture, 111 Federal Office Building, Minneapolis, Minnesota.

IMPORTANT

BE SURE TO FAMILIARIZE YOURSELF WITH THE FOLLOWING ABBREVIATIONS AND SYMBOLS BEFORE STUDYING THE RESULTS GIVEN IN THE TABLE.

TYPES OF TREATMENTS: FS - Foliage Spray; DS - Dormant Spray; CS - Cut Surface; CSF - Cut Surface Frills; CSC - Cut Surface Cups; BS - Basal Stem or GL - Ground Line Treatment; S - Soil.

SEASONS: S - Summer; F - Fall; W - Winter; Sp - Spring.

TYPES OF DOSAGES: PPM - Parts Per Million; AHG - Acid Per Hundred Gallons of Diluent; PPA - Pounds Per Acre of Acid Equivalent.

TYPES OF PLANTS CLASSED ACCORDING TO THEIR REACTION TO CHEMICALS:

I (Hypersensitive) - Any species or variety of a plant that is killed by one application of a given chemical.

II (Sensitive) - Any species or variety of a plant that is injured by a given chemical and may be killed by repeated applications. Probably most woody plants sensitive to the hormone-type of chemicals will fall in this class.

III (Semi-tolerant) - Any species or variety of a plant that is affected by a given chemical but is not killed by repeated applications. This group will include those plants that are merely defoliated by hormone sprays.

IV (Tolerant) - Any species or variety of a plant that shows negligible effect from an application of a given chemical.

Type of Treatment	Seasons Applied	Chemical Formulation	Conc.	Diluent	Reaction Type	State	Authority
Alder (Alnus incana)							
BS	W	2,4,5-T Ester	4000 ppm	D. Oil	II	Mich.	MWD
BS	S	2,4,5-T Ester	5000 ppm	D. Oil	I	Mich.	MWD
FS	S	2,4-D Ester	2000 ppm	Water	I & II	See 1949 Report	
FS	S	2,4,5-T Ester	2000 ppm	Water	II	See 1949 Report	
FS/CS	S-W	2,4-D / 2,4,5-T Esters	Var.	Water & Oil	I	See 1949 Report	
Alder, Green (Alnus crispa)							
FS	S	2,4-D Butyl Ester	2400 ppm	Water	II	Minn.	USFS
FS	S	2,4,5-T Butyl Ester	2400 ppm	Water	II	Minn.	USFS
Apple, Common (Pyrus malus)							
FS	S-F	2,4-D Esters	3000 ppm	Water	IV	See 1949 Report	
Apple, American Crab (Pyrus coronaria)							
FS	S-F	2,4-D Esters	3000 ppm	Water	II-III	See 1949 Report	
Apple, Crab (Malus baccata)							
FS	S	2,4-D Amine	Drift	Water	II	Sask.	HAF
Apple, Wild Crab (Pyrus ioensis)							
FS	S	2,4-D / 2,4,5-T Esters 50-50	2 ppa	Water	III	Iowa	S&H
CS	W	2,4-D / 2,4,5-T Esters 50-50	2 ppa	Oil	I	Iowa	S&H
Ash, green (Fraxinus pennsylvanica)							
FS	S	2,4-D Esters	4000 ppm	Water	IV	See 1949 Report	
FS	S	2,4,5-T	-	-	IV	See 1949 Report	
FS	S	2,4-D / 2,4,5-T Esters	Var.	Water	I-II	See 1949 Report	
FS	S	2,4-D / 2,4,5-T Esters 50-50	2 ppa	Water	III	Iowa	S&H
Ash (Fraxinus spp.)							
CS	W	2,4-D / 2,4,5-T Esters	8000 ppm	Oil	I-II	Pa.	GHB
Ash, prickly (Zanthoxylum americanum)							
FS	S	2,4-D High Ester	2000 ppm	Water	III	Minn.	JDM
FS	S	2,4-D High Ester	4000 ppm	Water	III	Minn.	JDM
FS	S	2,4-D High Ester	8000 ppm	Water	II	Minn.	JDM
FS	S	2,4-D Ethyl Ester	2000 ppm	Water	II	Minn.	JDM
FS	S	2,4-D Ethyl Ester	4000 ppm	Water	II	Minn.	JDM
FS	S	2,4-D Ethyl Ester	8000 ppm	Water	II	Minn.	JDM

Type of Treatment	Seasons Applied	Chemicals Used: Chemical Formulation	Conc.	Diluent	Reaction Type	State	Authority
Ash, prickly (Contd.)							
FS	S	2,4,5-T Esters	Var.	Water	III	See 1949 Report	
FS	S	2,4-D / 2,4,5-T Esters	Var.	Water	III	See 1949 Report	
FS	S	2,4-D Ester	2 ppa	Water	II	Iowa	S&H
FS	S	2,4-D / 2,4,5-T 50-50	2 ppa	Water	II	Iowa	S&H
FS	S	2,4,5-T High Ester	2000 ppm	Water	II	Minn.	JDM
FS	S	2,4,5-T High Ester	4000 ppm	Water	II	Minn.	JDM
FS	S	2,4,5-T High Ester	8000 ppm	Water	II	Minn.	JDM
FS	S	2,4,5-T Isopropyl & Amyl Ester	2000 ppm	Water	II	Minn.	JDM
FS	S	2,4,5-T Isop. & Amyl Es.	4000 ppm	Water	II	Minn.	JDM
FS	S	2,4,5-T Isop. & Amyl Es.	8000 ppm	Water	II	Minn.	JDM
FS	S	2,4-D / 2,4,5-T Butyl Ethyl Ester	2000 ppm	Water	II	Minn.	JDM
FS	S	2,4-D / 2,4,5-T Butyl Ethyl Ester	4000 ppm	Water	II	Minn.	JDM
FS	S	2,4-D / 2,4,5-T Butyl Eth. Ester	8000 ppm	Water	II	Minn.	JDM
CS	S	2,4-D / 2,4,5-T Esters	Var.	Water	II	Minn.	JDM
BS	W	2,4-D High Ester	25%	Turp.	II	Minn.	JDM
BS	W	2,4-D High Ester	5%	Turp.	II	Minn.	JDM
BS	W	2,4,5-T High Ester	2½%	Turp.	II	Minn.	JDM
BS	W	2,4,5-T High Ester	5%	Turp.	II	Minn.	JDM
Ash, white (*Fraxinus americana*)							
DS,BS	-	Propylene et al. Esters 2,4,5-T	16 AHG	Fuel Oil	II	Mich.	LLC
FS	S,F	2,4-D Esters	3000 ppm	Water	IV	See 1949 Report	
FS	S	2,4,5-T Esters	1500 ppm	Water	III	See 1949 Report	
DS	Dec. 1949	2,4-D / 2,4,5-T, 2-1	11 ppa	100 gal. Oil	II	NJ	ACP Co.
DS	"	2,4-D / 2,4,5-T Acid 2 to 1	11 ppa	100 gal. 1 Oil	II	NJ	ACP Co.
DS	Jan. 1950	2,4,5-T Ester	11 ppa	90 Water 10 Oil	I	NJ	ACP Co.
Barberry, Allegheny (*Berberis canadensis*)							
FS	S	2,4-D / 2,4,5-T, 2 to 1	1%	D. Oil	II	Va.-W.Va.	M&W
DS	F,W-Sp.	2,4-D / 2,4,5-T, 2 to 1	1½%	D. Oil	II	Va.-W.Va.	M&W
Barberry, native Colorado (*Berberis fendleri*)							
FS	S	2,4-D Ester	2000 ppm	Water	I	Colo.	M&L
DS	W,Sp.F	2,4-D / 2,4,5-T Esters 2 to 1	15000 ppm	Oil	I	Colo.	M&L
Basswood (*Tilia americana*)							
D	S	2,4-D Esters	8000 ppm	Oil	III	See 1949 Report	
FS	S	2,4-D / 2,4,5-T Esters	Var.	Water	IV	See 1949 Report	
Beech (*Fagus grandiflora*)							
BS	W	2,4,5-T Esters	1%	Oil	II	SC	DSHS
Birch (*Betula spp.*)							
DS	Dec. 1949	2,4-D / 2,4,5-T, 2 to 1	11ppa	100 gal. Oil	I	NJ	ACP Co.
DS	"	2,4-D / 2,4,5-T, 1 to 1	11ppa	100 gal.Oil	II	NJ	ACP Co.

Type of Treatment	Seasons Applied	Chemicals Used: Chemical Formulations	Conc.	Diluent	Reaction Type	State	Authority
Birch (Betula papyrifera)							
FS	S	2,4-D Ester	2000 ppm	Water	II	See 1949 Report	
FS	S	2,4,5-T Ester	2000 ppm	Water	II	See 1949 Report	
Birch, black (Betula lenta)							
FS	S	2,4,5-T ∕ 2,4-D Ester	3000 ppm	Water	III	See 1949 Report	
Birch, gray (Betula populifolia)							
FS	S	2,4-D Ester	1000 ppm	Water	II	See 1949 Report	
Birch, River (Betula nigra)							
FS	S	2,4-D ∕ 2,4,5-T Esters	Var.	Water	I	See 1949 Report	
FS	S	2,4-D ∕ 2,4,5-T Esters 50-50	2 ppa	Water	I	Iowa	S&H
Blackberry (Rubus spp.)							
FS	S	2,4-D Ester	2000 ppm	Water	IV	See 1949 Report	
DS	W	2,4-D Ester	8000 ppm	Oil	III	See 1949 Report	
FS	S,W	2,4,5-T Esters	Var.	Water or Oil	I	See 1949 Report	
FS	S	2,4-D ∕ 2,4,5-T Esters	Var.	Water	I	See 1949 Report	
FS	S,F-D	2,4-D ∕ 2,4,5-T Esters	2 ppa	Water	I	Iowa	S&H
Blackberry, wild (Rubus allegheniensis)							
FS	S	2,4-D Esters	3000 ppm	Water	IV	See 1949 Report	
FS	S	2,4,5-T Esters	1500 ppm	Water	I-II	See 1949 Report	
Black Brush (Acacia amentacea)							
FS	Sp,S	2,4,5-T Ester	1-1½ ppa	Diesel	III	Texas	RAD
FS	Sp.S	2,4,5-T Amine	1½ ppa	50% Diesel emuls.	III	Texas	RAD
FS		2,4-D ∕ 2,4,5-T Esters	1-1½ ppa	25% Diesel	III	Texas	RAD
FS	Sp.S	2,4-D Amine	1-1½ ppa	5% Diesel	III	Texas	RAD
Blueberry (Vaccinium pennsylvanicum)							
FS	S	2,4-D Butyl Ester	38,400ppm	Water	II	Minn.	USFS
FS	S	2,4,5-T Butyl Ester	19,200ppm	Water	II	Minn.	USFS
FS	S	2,4-D ∕ 2,4,5-T Butyl Ester	9.600 ppm	Water	II	Minn.	USFS
Blueberry (Vaccinium angustifolium var.)							
FS	S	2,4-D Esters	2000 ppm	Water	II	See 1949 Report	
Box Elder (Acer negundo)							
FS	Sp.	2,4-D Ester	Drift	Water	II	Sask.	HAF
FS	S	2,4-D Esters	-	-	I	See 1949 Report	
CS	Sp.	2,4-D ∕ 2,4,5-T Esters 50-50	2 ppa	Fuel Oil	I	Iowa	S&H
CS	Sp.	2,4-D ∕ 2,4,5-T Esters 50-50	2 ppa	Water	II	Iowa	S&H
Brier, common green (Smilax rotundifolia)							
FS	S	2,4-D Esters	3000 ppm	Water	IV	See 1949 Report	
DS	W	2,4-D Esters	8000 ppm	Oil	III	See 1949 Report	
DS	W	2,4,5-T Esters	8000 ppm	Oil	II	See 1949 Report	
FS	S	2,4-D ∕ 2,4,5-T Esters	Var.	Water	I-II	See 1949 Report	
Buckbrush (Symphoricarpos occidentalis)							
FS	Sp.	2,4-D ∕ 2,4,5-T Ester or Amate	1 ppa	Water	II	Sask.	HAF
FS	S	2,4-D Ester	1-2 ppa	Water	II	Nebr.	S&K

Type of Treatment	Seasons Applied	Chemicals Used: Chemical Formulation	Conc.	Diluent	Reaction Type	State	Authority
Buckbrush (Contd.)							
FS	S	2,4,5-T Ester	1-2 ppa	Water	III	Nebr.	S&K
FS	S	2,4-D Ester	Var.	Water	Var.	See 1949 Report	
FS	S	2,4-D Amines	Var.	Water	Var.	See 1949 Report	
FS	S	2,4,5-T Esters	Var.	Water	IV	See 1949 Report	
FS	S	2,4-D + 2,4,5-T Esters	Var.	Water	II	See 1949 Report	
FS	S	2,4-D + 2,4,5-T Esters	Var.	Water	I-II	See 1949 Report	
CS	Sp.	2,4-D + 2,4,5-T Esters 50-50	2 ppa	Fuel Oil	IV	Iowa	S&H
FS	Sp.	2,4-D + 2,4,5-T Esters 50-50	2 ppa	Water	II	Iowa	S&H
FS	S	2,4-D + 2,4,5-T Esters 50-50	2 ppa	Water	IV	Iowa	S&H
Buckeye, Red (Aesculus pavia)							
FS	S	2,4-D + 2,4,5-T Esters	Var.	Water	II	See 1949 Report	
Cactus, cholla (Opuntia imbricata)							
FS	S	2,4-D Ester	-	Oil	III	See 1949 Report	
FS	S	2,4-D Amine	-	Water	IV	See 1949 Report	
FS	S	2,4,5-T Ester	5%	Oil	II	See 1949 Report	
Cane (Arundinaria spp.)							
FS	S	2,4-D + 2,4,5-T Esters	6000 ppm	Water	I-II	See 1949 Report	
Catalpa (Catalpa bignenoides)							
FS	S	2,4-D + 2,4,5-T Esters	6000 ppm	Water	I	See 1949 Report	
Cat's Claw (Acacia gregg)							
FS	S	2,4,5-T Amine & Ester	5000 ppm	Water & Oil	II	Texas	F & Y
Cedar, dryland (Juniperus pinchotii)							
FS	S	2,4-D Ester	-	Oil	IV	See 1949 Report	
FS	S	2,4-D Amine	-	Water	IV	See 1949 Report	
FS	S	2,4,5-T Ester	1%	Oil	IV	See 1949 Report	
CS	All	2,4-D Amine	Undil.	-	II	Texas	F&Y
FS	All	2,4-D + 2,4,5-T Ester	2%	W & O	IV	Texas	F&Y
Cedar, Red (Juniperus virginiana)							
FS	S	2,4-D + 2,4,5-T Esters	Var.	Water	II-IV	See 1949 Report	
Cedar, salt (Tamarix gallica)							
FS	S	2,4-D Na Salt	4 ppa	Water	II-III	See 1949 Report	
CS	S	2,4-D Ester	5%	Oil	I	See 1949 Report	
FS	S	2,4,5-T Ester	4 ppa	Water	I-II	See 1949 Report	
FS	S	2,4-D + 2,4,5-T Ester	4 ppa	Water	II	See 1949 Report	
Chaparral (Candalia obtusifolia)							
FS	S	2,4-D + 2,4,5-T Ester	1%	Water	II	Texas	F&Y
FS	All	2,4-D + 2,4,5-T Ester	1%	Oil	II	Texas	F&Y
CS	All	2,4-D + 2,4,5-T Ester	1%	Oil	II	Texas	F&Y
Cherry (Prunus spp.)							
DS	Dec. 1949	2,4-D + 2,4,5-T, 2 to 1	11 ppa	100 gal. Oil	I	NJ	ACPCo.
Cherry, choke (Prunus virginiana)							
FS	S	2,4-D Ester	2000 ppm	Water	II	See 1949 Report	
DS	W	2,4-D Ester	4000 ppm	Oil	II	See 1949 Report	
FS	S	2,4,5-T Esters	Var.	Water	Var.	See 1949 Report	
FS	S	2,4-D Ester + 2,4,5-T	8000 ppm	Water	I	See 1949 Report	

Type of Treatment	Seasons Applied	Chemicals Used: Chemical Formulations	Conc.	Diluent	Reaction Type	State	Authority
Cherry, Pin (Prunus pennsylvanica)							
BS	W	2,4,5-T Ester	5000 ppm	D. Oil	I	Mich.	MWD
FS	S	2,4-D / 2,4,5-T	8000 ppm	Water	I	See 1949 Report	
Cherry, Sweet (Prunus avium)							
FS	S	2,4-D / 2,4,5-T	3000 ppm	Water	I	See 1949 Report	
Cherry, wild (Prunus serotina)							
FS	Sp.S	2,4-D / 2,4,5-T Ester	1 gal. A.	Water	I	Pa.	GHB
FS	S	2,4-D Ester	3000 ppm	Water	I	See 1949 Report	
FS	S	2,4-D Ester	2000 ppm	Water	II	See 1949 Report	
DS	W	2,4-D Ester	4000 ppm	Oil	III	See 1949 Report	
FS/DS	S,W	2,4,5-T Esters	Var.	W&O	I-II	See 1949 Report	
FS	S	2,4-D / 2,4,5-T	Var.	W	I	See 1949 Report	
CS	Sp.	2,4-D / 2,4,5-T, 50-50	2 ppa	Oil	I	Iowa	S&H
Chestnut (Castanea dentata)							
FS	S	2,4-D Ester	1000 ppm	Water	III-IV	See 1949 Report	
DS	Dec. 1949	2,4-D / 2,4,5-T, 2 to 1	11 ppa	Oil 100 gal.	I	NJ	ACP Co.
Chokeberry (Aronia melanocarpa)							
FS	S	2,4-D Esters	2000 ppm	Water	IV	See 1949 Report	
Cottonwood (Populus deltoides)							
FS	S	2,4-D Esters	3000 ppm	Water	II	See 1949 Report	
FS	S	2,4-D / 2,4,5-T Esters	Var.	Water	I-II	See 1949 Report	
Cottonwood (Populus sargentii)							
BS	Late S	2,4-D Ester	5%	D.Oil	I	Nebr.	S&K
BS	Late S	2,4,5-T Ester	5%	D.Oil	I	Nebr.	S&K
BS	Late S	2,4-D Amine	5%	Water	IV	Nebr.	S&K
BS	Late S	2,4,5-T Amine	5%	Water	IV	Nebr.	S&K
BS	Late S	2,4-D / a,2,4,5-T Ester	5%	Water	IV	Nebr.	S&K
BS	Late S	2,4-D / 2,4,5-T Ester	5%	D.Oil	I	Nebr.	S&K
Cranberry (Vaccinium oxycoccus)							
FS	S	2,4-D Butyl Ester	9600 ppm	Water	II	Minn.	USFS
FS	S	2,4,5-T Butyl Ester	9600 ppm	Water	II	Minn.	USFS
FS	S	2,4-D / 2,4,5-T Ester (Butyl)	4800 ppm	Water	II	Minn.	USFS
Creeper, Virginia (Parthenocissus quinquefolia)							
FS	S	2,4-D Ester	Votal.	-	II	Sask.	HAF
Cucumber Tree (Magnolia acuminata)							
FS	S	2,4-D / 2,4,5-T Ester	3000 ppm.	Water	II	See 1949 Report	
Currant (Ribes tularense)							
FS	S	2,4,5-T Ester	4000 ppm	Water	II-III	See 1949 Report	
Currant, Alpine (Ribestmontigenum)							
FS/CS	All	2,4-D Esters & Salts	1000 ppm	Water	IV	See 1949 Report	
Currant, American black (Ribes americanum)							
FS	S	2,4-D Salts & Esters	1000 ppm	Water	I	See 1949 Report	
FS/BS	S	2,4,5-T Esters	Var.	O&W	I	See 1949 Report	
FS	S	2,4-D / 2,4,5-T Esters	Var.	Water	I	See 1949 Report	
Currant, Crater Lake (R. erythrocarpum)							
FS	S	2,4,5-T Acid & Am.	Var.	W&O	II	See 1949 Report	
Currant, golden (Ribes aureum)							
FS	Sp.	2,4-D Ester	Drift	Water	II	Sask.	HAF

Type of Treatment	Seasons Applied	Chemicals Used: Chemical Formulations	Conc.	Diluent	Reaction Type	State	Authority
Current, Hudson Bay (Ribes hudsenianum)							
FS	S	2,4-D Salts & Esters	1000 ppm	Water	I	See 1949 Report	
FS	S	2,4,5-T Ester	1000 ppm	Water	I	See 1949 Report	
FS	S	2,4-D / 2,4,5-T Ester	2000 ppm	Water	I	See 1949 Report	
Currant, prickly (Ribes lacustre)							
FS/CS	All	2,4-D Salts & Esters	1000 ppm	Water	IV	See 1949 Report	
FS/CS	S	2,4,5-T Ester	2000 ppm	Water	I	See 1949 Report	
Currant, red flower (Ribes sanguinem)							
FS/CS	S	2,4-D Salts & Esters	750 ppm	Water	II-III	See 1949 Report	
FS	S	2,4,5-T Am. Salt	2000 ppm	Water	I-III	See 1949 Report	
Currant, Sier. Nevada (Ribes nevadense)							
FS/CS	S	2,4-D Salts & Esters	500 ppm	Water	I-II	See 1949 Report	
FS	S	2,4,5-T Am. Salt	Var.	Water	I-III	See 1949 Report	
FS	S	2,4-D / 2,4,5-T Ester	2000 ppm	Water	I	See 1949 Report	
Currant, skunk (Ribes glandulosum)							
FS	S	2,4,5-T Ester	6000 ppm	Water	II-III	See 1949 Report	
FS	S	2,4-D / 2,4,5-T Ester	12000 ppm	Water	II-III	See 1949 Report	
Currant, Squaw (Ribes cereum)							
FS/CS	S	2,4-D Esters & Salts	1000 ppm	Water	II	See 1949 Report	
FS	S	2,4,5-T Esters	Var.	Water	II-III	See 1949 Report	
FS	S	2,4-D / 2,4,5-T Ester	2000 ppm	Water	I-II	See 1949 Report	
Currant, sticky (Ribes viscosissimum)							
FS/CS	S	2,4,5-T Esters	2000 ppm	Water	I	See 1949 Report	
Currant, stink (Ribes bracteosim)							
FS	S	2,4-D Salts & Esters	250 ppm	Water	I-II	See 1949 Report	
Currant, Swamp Red (Ribes triste)							
FS	S	2,4,5-T Ester	6000 ppm	Water	II-III-IV	See 1949 Report	
FS	S	2,4-D / 2,4,5-T Ester	12,000 ppm	Water	II-III-IV	See 1949 Report	
Currant, West. black (Ribes petiolare)							
FS/CS	S	2,4-D Salts & Esters	250 ppm	Water	I-II	See 1949 Report	
FS	S	2,4,5-T Esters	2000 ppm	Water	I	See 1949 Report	
Currant, wild (Ribes oxyacanthus)							
FS	S	2,4-D Ester	2000 ppm	-	-	See 1949 Report	
Dewberry (Rubus flagellaris)							
FS	S	2,4-D Esters	3000 ppm	Water	III	See 1949 Report	
Dogwood (Cornus spp.)							
DS	Dec. 1949	2,4-D / 2,4,5-T, 2 to 1	11 ppa	100 gal. Oil	I	NJ	ACP Co.
Dogwood (Cornus asperifolia)							
FS	S	2,4-D / 2,4,5-T Esters 50-50	2 ppa	Water	III	Iowa	S&H
Dogwood (Cornus stolonifera)							
FS	S	2,4-D Esters	1-2 ppa	-	II	See 1949 Report	
Dogwood, flowering (Cornus florida)							
BS	W	2,4,5-T Esters	1%	Oil	I	S.C.	USFS
BS	S	2,4-D / 2,4,5-T Esters	Var.	Water	I-II	See 1949 Report	
Dogwood, round leaf (Cornus circinata)							
FS	S	2,4-D Butyl Ester	2400 ppm	Water	II	Minn.	USFS
FS	S	2,4,5-T Butyl Ester	2400 ppm	Water	II	Minn.	USFS
FS	S	2,4-D / 2,4,5-T Butyl Ester	2400 ppm	Water	II	Minn.	USFS

Type of Treatment	Seasons Applied	Chemicals Used: Chemical Formulations	Conc.	Diluent	Reaction type	State	Authority
Elderberry (Sambucus spp.)							
FS	-	2,4-D Ester	2000 ppm	Water	I	Pa.	GHB
FS	S	2,4-D Ester	2000 ppm	Water	I	See 1949 Rep.	
Elderberry (Sambucus canadensis)							
FS	S	2,4-D Ester	3000 ppm	Water	I-II	See 1949 Report	
FS	S	2,4,5-T Ester	2000 ppm	Water	II	See 1949 Report	
FS	S	2,4-D / 2,4,5-T Ester	Var.	Water	I-II	See 1949 Report	
Elder, European red (Sambucus racemosa)							
FS	Sp.	2,4-D Ester	Drift	Water	II	Sask.	HAF
Elm (Ulnus spp.)							
FS	S	2,4-D Esters	3000 ppm	Water	I-II	See 1949 Report	
DS	Dec. 1949	2,4-D / 2,4,5-T, 2-1	11 ppa	100 gal. Oil	III	NJ	ACP Co.
Elm, American (Ulmus americana)							
FS	S	2,4,5-T Ester	1500 ppm	Water	I-II	See 1949 Report	
FS	S	2,4-D / 2,4,5-T Ester	Var.	Water	I	See 1949 Report	
FS/DS	S,W	2,4-D Esters	Var.	W & O	I-III	See 1949 Report	
Elm, slippery (Ulmus fulva)							
FS	S	2,4-D Ester	4000 ppm	Water	IV	See 1949 Report	
FS	S	2,4,5-T	-	-	IV	See 1949 Report	
FS	S	2,4-D / 2,4,5-T Ester	Var.	Water	I	See 1949 Report	
FS	S	2,4-D / 2,4,5-T, 50-50	2 ppa	Water	II	Iowa	S&H
CS	S	2,4-D / 2,4,5-T, 50-50	2 ppa	Oil	III	Iowa	S&H
Elm, winged (Ulmus alata)							
FS	S	2,4-D / 2,4,5-T Ester	4000 ppm	Water	I	See 1949 Report	
Fern, sweet (Comptonia peregrina)							
FS	S	2,4-D Ester	Var.	Water	I	See 1949 Report	
Gooseberry, gummy (Ribes lobbii)							
FS/CS	S	2,4-D Esters & Salts	1000 ppm	Water	II-III	See 1949 Report	
FS	S	2,4,5-T Salts	Var.	Water	I-II-III	See 1949 Rep.	
Gooseberry, Missouri (Ribes Missouriense)							
FS/BS	S	Esters of 2,4,5-T	Var.	O&W	I-II-III	See 1949 Rep.	
FS	S	2,4-D / 2,4,5-T Esters	12,000 ppm	W	II-III	" " "	
Gooseberry, prickly (Ribes cynosbati)							
FS/BS	S	2,4,5-T Esters	Var.	O&W	I-II-III	See 1949 Rep.	
FS	S	2,4-D / 2,4,5-T Esters	12,000 ppm	W	II-III	See 1949 Report	
Gooseberry, Sier. Nevada (Ribes roezli)							
FS/CS	S	2,4-D Esters & Salts	250 ppm	Water	I-II	See 1949 Rep.	
FS	S	2,4,5-T Sod. Salt	Var.	Water	II-III	See 1949 Rep.	
FS	S	2,4-D / 2,4,5-T Esters	2000 ppm	Water	I-II	See 1949 Rep.	
Gooseberry, Siskiyou (Ribes binominatum)							
FS	S	2,4-D Esters & Salts	2000 ppm	Water	II-III	See 1949 Rep.	
FS	S	2,4,5-T Salts	Var.	Water	I-II	See 1949 Rep.	
Gooseberry, smooth (Ribes hirtellum)							
FS	S	2,4,5-T Esters	6000 ppm	Water	II-III	See 1949 Rep.	
FS	S	2,4-D / 2,4,5-T Esters	12,000 ppm	Water	II-III	See 1949 Rep.	
Gooseberry, White St. (Ribes inerme)							
FS	S	2,4-D Esters & Salts	2000 ppm	Water	II-III	See 1949 Rep.	
FS	S	2,4,5-T Esters	2000 ppm	Water	I	See 1949 Rep.	

Type of Treatment	Seasons Applied	Chemicals Used: Chemical Formulations	Conc.	Diluent	Reaction type	State	Authority
Grape, wild (Vitus vulpina)							
FS	S	2,4-D Esters	2000 ppm	Water	II	See 1949 Report	
FS	S	2,4-D & 2,4,5-T Esters	Var.	Water	I	See 1949 Report	
FS	S	2,4-D & 2,4,5-T Esters 50-50	2 ppa	Water	I	Iowa	S&H
Gum, black or tupelo (Nyssa sylvatica)							
CS Cup	S	Amate	Dry Salt	-	I	NJ	USFS
FS	S	2,4-D Am. Salt	4500 ppm	Water	I-II	See 1949 Report	
CS	W	2,4-D Ester	5%	Oil	I	See 1949 Report	
CS	W	2,4,5-T Ester	2½%	Oil	I	See 1949 Report	
FS	S	2,4-D & 2,4,5-T Esters	Var.	Water	I-II-III	" 1949 Report	
FS	S	2,4,5-T Esters	2500 ppm	Water	II	SC	USFS
CS	W	2,4,5-T Esters	3%	Oil	II	SC	USFS
CS	W	2,4,5-T Ester	Var.	Oil	I	See 1949 Report	
FS	S	2,4-D & 2,4,5-T	Var.	Water	II-III-IV	" "	"
Gum, sweet (Liquidambar styraciflua)							
FS	S	2,4,5-T Ester	2500 ppm	Water	II	SC	USFS
CS	W,S	2,4,5-T Esters	3%	Oil	II	SC	USFS
CS/FS	W,S	2,4-D Esters	Var.	-	II-III	See 1949 Report	
CS/FS	W,S	2,4,5-T Esters	Var.	O&W	I	See 1949 Report	
FS	S	2,4-D & 2,4,5-T Esters	Var.	W	I-II	See 1949 Report	
Hackberry (Celtis occidentalis)							
FS	S	2,4-D Ester	4000 ppm	Water	IV	See 1949 Report	
FS	S	2,4,5-T Ester	-	-	IV	See 1949 Report	
Hardhack (Spirea tomentosa)							
FS/CS	W,Sp.S	2,4-D & 2,4,5-T	1 gal./A.	Water	I	Pa.	GHB
Hawthorn (Crataegus spp.)							
DS/BS		Ester of 2,4,5-T, Prop.et al. 16 AHG		Fuel Oil	II	Mich.	LLC
FS		2,4-D & 2,4,5-T Esters	1½ ppa	Water	I	Menit.	HW
FS/CS	W,Sp.S	2,4-D & 2,4,5-T Esters	1 gal/A	Water	II	Pa.	GHB
FS/DS	W,S	2,4-D Esters	Var.	Var.	II-III	See 1949 Report	
FS/CS	S,W	2,4-D & 2,4,5-T Esters	Var.	Var.	I	See 1949 Report	
FS	S	2,4,5-T Ester	Var.	Water	II-III	See 1949 Report	
Hazel, beaked (Corylus cornuta)							
FS	Early S	2,4-D Ester	1500 ppm	Water	II	Minn.	HLH
FS	Mid S	2,4-D Ester	1500 ppm	Water	II	Minn.	HLH
FS	Late S	2,4-D Ester	1500 ppm	Water	III	Minn.	HLH
FS	Early S	2,4,5-T Ester	3000 ppm	Water	II	Minn.	HLH
FS	Mid S	2,4,5-T Ester	3000 ppm	Water	II	Minn.	HLH
FS	Late S	2,4,5-T Ester	3000 ppm	Water	III	Minn.	HLH
FS	Early S	2,4-D & 2,4,5-T Esters	3000 ppm	Water	II	Minn.	HLH
FS	Mid S	2,4-D & 2,4,5-T Esters	3000 ppm	Water	II	Minn.	HLH
FS	Late S	2,4-D & 2,4,5-T Esters	3000 ppm	Water	III	Minn.	HLH
FS/DS	S&W	2,4-D Esters	Var.	Var.	I-II	See 1949 Report	
FS	S	2,4-D & 2,4,5-T Esters	8000 ppm	Water	II	See 1949 Report	
FS	S	2,4,5-T Ester	2000 ppm	Water	II	See 1949 Report	
Hazel, brush (Corylus spp.)							
FS	S	Var. 2,4-D Esters	1-2 ppa	Water	I-II	See 1949 Report	

Type of Treatment	Seasons Applied	Chemicals Used: Chemical Formulations	Conc.	Diluent	Reaction Type	State	Authority
Hazelnut (Corylus americana)							
FS	S	2,4-D	1/2 ppa	Water	I	Man.	HEW
FS	S	2,4,5-T Ester	8000 ppm	Oil	II	See 1949 Report	
FS	S	2,4-D / 2,4,5-T Esters 50-50	2 ppa	Water	III	Iowa	S&H
FS	S	2,4-D Ester	2ppa	Water	II	Iowa	S&H
DS	Dec.	2,4-D / 2,4,5-T, 2-1	11 ppa	100 Oil	II	NJ	ACP Co.
DS	1949	2,4,5-T Ester	11 ppa	90 Water 10 Oil	I	NJ	ACP Co.
Hickory (Carya spp.)							
FS	S	2,4-D / 2,4,5-T Esters	Var.	Water	I	See 1949 Report	
FS	S	2,4-D / 2,4,5-T Esters 50-50	2 ppa	Water	II	Iowa	S&H
CS	W	2,4-D / 2,4,5-T Esters 50-50	2 ppa	Oil	I	Iowa	S&H
DS	Dec.1949	2,4-D / 2,4,5-T, 2 to 1	11 ppa	100 gal. Oil	I	NJ	ACP Co.
Hickory Bitternut (Carya cordiformis)							
DS	Dec. 1949	2,4-D / 2,4,5-T Esters 2 to 1	11 ppa	100 gal. Oil	I	NJ	ACP Co.
Hickory, pignut (Carya glabra)							
BS	W	2,4,5-T Esters	1%	Oil	II	SC	USFS
CS	S	2,4,5-T Esters	5%	Oil	II	SC	USFS
Hickory, shellbark (Carya ovata)							
FS	S	2,4-D Esters	3000 ppm	Water	III	See 1949 Report	
DS	W	2,4,5-T Esters	8000 ppm	Oil	I	See 1949 Report	
Honeysuckle (Lonicera tartarica)							
FS	Sp.	2,4-D Ester	Drift	Water	II	Sask.	HAF
Honeysuckle (Lonicera japonica)							
FS	S	2,4-D / 2,4,5-T Esters	6000 ppm	Water	I	See 1949 Report	
Honeysuckle, American Fly (Lonicera canadensis)							
FS	S	2,4-D Butyl Ester	2400 ppm	Water	IV	Minn.	USFS
FS	S	2,4,5-T Butyl Ester	2400 ppm	Water	IV	Minn.	USFS
Honeysuckle, Bush (Diervilla lonicera)							
FS	S	2,4-D Butyl Ester	2400 ppm	Water	II	Minn.	USFS EIR
FS	S	2,4,5-T Butyl Ester	2400 ppm	Water	II	Minn.	USFS EIR
FS	S	2,4-D / 2,4,5-T Butyl Ester	2400 ppm	Water	II	Minn.	USFS EIR
Honeysuckle, hairy (Lonicera hirsuta)							
FS	S	2,4-D Butyl Ester	2400 ppm	Water	II	Minn.	USFS EIR
Honeysuckle, wild (Lonicera spp.)							
FS	Sp.S	2,4-D / 2,4,5-T Ester	1 gal./A	Water	I	Pa.	JHB
Horsebush, spineless (Tetradymia canescens)							
FS	Sp.	2,4-D / 2,4,5-T. Esters	1/12 to 3 ppa	Oil & Water	IV	Wyo.	USFS

Type of Treatment	Seasons Applied	Chemical Formulations	Conc.	Diluent	Reaction type	State	Authority
Huisache (Acacia farnesiana)							
BS	Sp.S	2,4,5-T Ester	10,000ppm	Diesel	II	Texas	RHD
CS	Sp.S	2,4,5-T Ester	10,000ppm	Diesel	II	Texas	RHD
Hydrangea, wild (Hydrangea arborescens)							
FS	S	2,4-D / 2,4,5-T Esters	3,00 ppm	Water	I-II	See 1949 Report	
Ironwood (Ostrya virginiana)							
BS	W	2,4,5-T Esters	1%	Oil	I	SC	USFS
Ivy, Poison (Rhus radicens rydbergii)							
FS	S	2,4-D Ester	Var.	Water	II	See 1949 Report	
Ivy, Poison (Rhus toxicodendron)							
FS	Sp.S	2,4-D / 2,4,5-T Ester	1 gal/A	Water	I	Pa.	GHB
FS	S	2,4-D Var. Esters	Var.	Water	II-III	See 1949 Report	
FS	S	2,4,5-T Esters	Var.	Water	L-II	See 1949 Report	
FS	S	2,4-D / 2,4,5-T Esters	Var.	Water	I	See 1949 Report	
FS	S	2,4-D / 2,4,5-T Esters	2 ppa	Water	I	Iowa	S&H
Juneberry (Amelanchier alnifolia)		50-50					
BS	W	2,4,5-T Ester	5000 ppm	D.Oil	I	Mich.	MWD
FS	S	2,4-D Ester	Var.	Water	II	See 1949 Report	
FS	S	2,4,5-T Ester	Var.	Water	II	See 1949 Report	
FS	S	2,4-D / 2,4,5-T Ester	Var.	Water	II	See 1949 Report	
Kudzu (Pueraria thunbergiana)							
FS	S	2,4-D / 2,4,5-T Ester	6000 ppm	Water	I	See 1949 Report	
Laurel, sheep (Kalmia angustifolia)							
FS	S	2,4-D Ester	-	-	II	See 1949 Report	
Laurel, swamp (Kalmia polifolia)							
FS	S	2,4-D Butyl Ester	38,400 ppm	Water	II	Minn.	USFS
FS	S	2,4,5-T Butyl Ester	38,400 ppm	Water	II	Minn.	USFS
FS	S	2,4-D / 2,4,5-T Butyl Ester	38,400 ppm	Water	II	Minn.	USFS
Leatherleaf (Chamaedaphne calyculata)							
FS	S	2,4-D Butyl Ester	38,400 ppm	Water	II	Minn.	USFS
FS	S	2,4,5-T But. Ester	19,200 ppm	Water	II	Minn.	USFS
FS	S	2,4-D / 2,4,5-T Butyl Ester	19,200 ppm	Water	II	Minn.	USFS
Lingonberry (Vaccinium Vitis-idaea)(var. minus)							
FS	S	2,4-D Butyl Ester	9,600 ppm	Water	II	Minn.	USFS
FS	S	2,4-D / 2,4,5-T Ester	19,200 ppm	Water	II	Minn.	USFS
Locust, black (Robinia pseudoacacia)							
FS	S	Var. Esters 2,4-D	Var.	Water	I-II	See 1949 Report	
FS	S	2,4,5-T Esters	Var.	Water	I-II	See 1949 Report	
FS	S	2,4-D / 2,4,5-T Esters	Var.	Water	I-II	See 1949 Report	
FS	S	2,4-D / 2,4,5-T Esters 50-50	2 ppa	Water	I	Iowa	S&H
Locust, honey (Gleditsia triacanthos)							
FS	S	2,4-D Ester	2 ppa	Water	IV	See 1949 Report	
FS	S	2,4-D / 2,4,5-T Esters	6000 ppm	Water	I	See 1949 Report	
FS	S	2,4,5-T	-	-	II	See 1949 Report	
Lote bush (Condalia obtusifolia)							
CS/FS	W,S	2,4-D Esters & Amines	Var.	O&W	II-III-IV	"	"
CS/FS	W,S	2,4,5-T Ester	Var.	Oil	I-II	See 1949 Report	

Type of Treatment	Seasons Applied	Chemicals Used: Chemical Formulations	Conc.	Diluent	Reaction type	State	Authority
Mahonia	(Mahonia repens)						
FS	S	2,4-D Esters	Drift	W&O	IV	Colo.	M&L
Maple	(Acer spp.)						
DS	Dec. 1949	2,4-D / 2,4,5-T 2 to 1	11 ppa	100 gal. 100il	I	NJ	ACP Co.
Maple, Mountain	(Acer spicatum)						
FS	Early S	2,4-D Iso. Ester	1500 ppm	Water	III	Minn.	HLH
FS	Mid S	2,4-D Isop. Ester	1500 ppm	Water	III	Minn.	HLH
FS	Late S	2,4-D Isop. Ester	1500 ppm	Water	III	Minn.	HLH
FS	Early S	2,4,5-T Ester, Isop.	3000 ppm	Water	III	Minn.	HLH
FS	Mid S	2,4,5-T Isop. Ester	3000 ppm	Water	III	Minn.	HLH
FS	Late S	2,4,5-T Isop. Ester	3000 ppm	Water	III	Minn.	HLH
FS	Early S	2,4-D / 2,4,5-T Ester	3000 ppm	Water	III	Minn.	HLH
FS	Mid S	2,4-D / 2,4,5-T Esters	3000 ppm	Water	III	MINN.	HLH
FS	Late S	2,4-D / 2,4,5-T Esters	3000 ppm	Water	III	Minn.	HLH
CS		2,4-D / 2,4,5-T Esters	8000 ppm	Oil	I	See 1949 Report	
Maple, red	(Acer rubrum)						
CS Cup	S	Amate	Dry Salt	-	I-II	NJ	USFS
BS	S	2,4,5-T Esters	8000 ppm	D. Oil	I	Mich.	MWD
Inject.	S	2,4,5-T Ester	8000 ppm	D.Oil	I	Mich.	MWD
FS	S	2,4-D Esters	Var.	Water	III-IV	See 1949 Report	
FS/CS	S,W	2,4-D / 2,4,5-T Esters	Var.	O&W	I-II	See 1949 Report	
FS	S	2,4,5-T Esters	2000 ppm	W	II	See 1949 Report	
Maple, silver or soft	(Acer saccharinum)						
FS	S	2,4-D / 2,4,5-T Ester	6000 ppm	Water	I	See 1949 Report	
Maple, sugar	(Acer saccharum)						
DS/BS	-	Propylene et al.	16 AHG	Fuel Oil	II	Mich.	LLC
CS/W	-	Ester 2,4,5-T					
CS/FS	-	2,4-D Esters	Var.	O&W	II-III	See 1949 Report	
DS/FS	W,S	2,4,5-T Esters	Var.	O&W	II-III-IV	See 1949 Report	
Meadow Sweet	(Spirea saliafolia)						
FS	S	2,4,5-T Butyl Ester	38,400 ppm	Water	II	Minn.	USFS
FS	S	2,4,5-T Butyl Ester	4,800 ppm	Water	II	Minn.	USFS
Mesquite	(Presopis juliflora glan.)						
CS/FS	Var.	2,4-D Esters & Am.	Var.	W&O	II-III-IV	See 1949 Report	
FS	S	2,4-D / 2,4,5-T Esters	Var.	W	I-II-III	See 1949 Report	
FS/CS	S,W	2,4,5-T Esters	Var.	Oil	II-III	See 1949 Report	
FS	S	2,4,5-T Esters	2/3 ppa	1-Water 3-Oil	II	Texas	F&Y
DS	F,W,S	2,4,5-T Esters	1%	Oil	II	Texas	F&Y
CS	All	2,4,5-T Esters	1%	Oil	II	Texas	F&Y
BS	All	2,4,5-T Esters	1%	Oil	II	Texas	F&Y
Mulberry, red	(Morus rubra)						
FS	S	2,4-D / 2,4,5-T Esters	6000 ppm	Water	II	See 1949 Report	
Myrtle, Wax	(Myrica cerifera)						
FS	S	2,4,5-T Esters	2500 ppm	Water	II	SC	USFS
BS	W	2,4,5-T Esters	1%	Oil	I	SC	USFS
FS	S	2,4-D Am. Salt	4500 ppm	Water	II	See 1949 Report	
CS	W	2,4-D Ester	5%	Oil	I	See 1949 Report	
CS	W	2,4,5-T Ester	2½%	Oil	I	See 1949 Report	

Type of Treatment	Seasons Applied	Chemical Formulations	Conc.	Diluent	Reaction type	State	Authority
Oak, (Quercus spp.)							
DS	Dec. 1949	2,4-D / 2,4,5-T Ester, 2/1	11 ppa	100 gal. Oil	I	NJ	ACP Co.
DS	"	2,4-D / 2,4,5-T Acid	11 ppa	100 gal. Oil	II	NJ	ACP Co.
Oak, Black Jack (Quercus marilandica)							
CS	W	2,4,5-T Esters	3%	Oil	I	SC	USFS
BS	W	2,4,5-T Esters	5%	Oil	II	SC	USFS
FS/CS	Var.	2,4-D Salts & Esters	Var.	Water	II-III-IV	See 1949 Repo	
CS/FS	Var.	2,4-D / 2,4,5-T Esters	Var.	Water	I-II	See 1949 Repo	
CS/FS	-	2,4,5-T	20,000 ppm	Water	II	See 1949 Rep.	
Oak, Bur (Quercus macrocarpa)							
FS	S	2,4-D / 2,4,5-T Esters	1½ ppa	Water	I-II	Manit.	HEW
FS	S	2,4-D Var. Esters	2 ppa	Water	IV	See 1949 Report	
Oak, Chestnus (Quercus montana)							
FS	S	2,4-D / 2,4,5-T Esters	Var.	Water	I	See 1949 Report	
Oak, Laurel or Shingle (Quercus imbricaria)							
FS	S	2,4-D Esters 50-50	3000 ppm	Water	III-IV	See 1949 Report	
CS	W	2,4-D / 2,4,5-T Esters	2 ppa	Oil	II	Iowa	S&H
FS	S	2,4-D / 2,4,5-T Esters 50-50	2 ppa	Water	IV	Iowa	S&H
Oak, Live (Quercus virginiana)							
BS	W	2,4,5-T Esters	5%	Oil	II	SC	USFS
CSF	S	2,4,5-T Esters	1%	Water	I	SC	USFS
Oak, Northern Red (Quercus borealis)							
FS	S	2,4-D / 2,4,5-T Esters	Var.	Water	I-II	See 1949 Report	
Oak, Mixed Stand (Quercus spp.)							
CS Cup	S	Amate	Dry Salt	-	II	NJ	USFS
CS	F	Amate	Dry Salt	-	I-II	NJ	USFS
CS/BS	F	2,4-D / 2,4,5-T	5%	Oil	I	NJ	USFS
CS Stump	S	Amate	Dry Salt	-	II	NJ	USFS
FS	S	Amate	32.4%	Water	II	NJ	USFS
CS/BS	W	Amate	32.4%	Water	II	NJ	USFS
CS/BS		2,4-D / 2,4,5-T Esters	5%	Oil	II	NJ	USFS
Oak, Post (Quercus stellata)							
CS	W,Sp	2,4,5-T Ester	12,000 ppm	Diesel	II	Texas	RAD
CS	W,Sp	2,4-D / 2,4,5-T Esters	15,000 ppm	Diesel	II	Texas	RAD
CS	W,S	2,4,5-T Esters	3%	Oil	II	SC	USFS
CS Prill	W,S	2,4,5-T Esters	1%	Water	I	SC	USFS
BS	W	2,4,5-T Esters	3%	Oil	II	SC	USFS
FS	S	2,4-D Salt & Ester	Var	O&W	II	See 1949 Report	
FS	S	2,4-D / 2,4,5-T Esters	Var.	Water	I	See 1949 Report	
FS		2,4,5-T Ester	2½%	Oil	I	See 1949 Report	
FS	Sp.S	2,4,5-T Ester	1-1½ ppa	25% Dies.	III	Texas	RAD
FS	Sp.S	2,4,5-T Amine	1½ ppa	50% Dies.	III	Texas	RAD
FS	Sp.S	2,4-D / 2,4,5-T Esters	1½ ppa	25-50% Diesel	III	Texas	RAD
FS	Sp.S	2,4-D Ester	1 ppa	Diesel	III	Texas	RAD
BS	W	2,4-D Ester	20,000 ppm	Diesel	II	Texas	RAD
BS	W,Sp.	2,4,5-T Ester	20,000 ppm	Diesel	II	Texas	RAD
BS	W	2,4-D / 2,4,5-T Esters	20,000ppm	Diesel	III	Texas	RAD

Type of Treatment	Seasons Applied	Chemical Formulations	Conc.	Diluent	Reaction type	State	Authority
Oak, Red (Quercus rubra)							
FS	S	2,4-D Esters	3000 ppm	Water	III-IV-	See 1949 Report	
Oak, Scarlet (Quercus coccinea)							
FS	S	2,4-D / 2,4,5-T Esters	Var.	Water	I	See 1949 Report	
Oak, Scrub (Quercus gambeli)							
FS	S	2,4-D Esters	Var.	Water	II-IV	See 1949 Report	
FS	S	2,4-D / 2,4,5-T Esters	1000 ppm	Water	III	See 1949 Report	
FS	S	2,4,5-T Esters	Var.	Water	II	See 1949 Report	
Oak, Scrub (Quercus illicifolia)							
FS	S	2,4-D Var. Esters	2000 ppm	Water	III-IV	See 1949 Report	
Oak, Scrub (Quercus ellipsoidalis)							
CS-Frills	S	Amate	Dry Salt	-	II	Wis.	USFS
Oak, Shinnery (Quercus havardi)							
FS	Sp	2,4-D All Types	1-4 ppa	Emuls. & Oils	IV	Okla.	EHM
BS	S	2,4,5-T All Types	1-4 ppa	Emuls. & Oils	IV	Okla.	EHM
Oak, Southern red (Quercus falcata							
CS-Frills	W,S	2,4,5-T Ester	1%	Water	II	SC	USFS
Oak, Water (Quercus nigra)							
CS	W,S	2,4,5-T Esters	3%	Oil	II	SC	USFS
CS-Frills	W,S	2,4,5-T Esters	1%	Water	II	SC	USFS
DS	-	2,4,5-T Esters	20%	Oil	I	See 1949 Report	
Oak, White (Quercus alba)							
FS	S	2,4-D Esters	3000 ppm	Water	III-IV	See 1949 Report	
FS	S	2,4-D / 2,4,5-T Esters	Var.	Water	I-II	See 1949 Report	
FS	S	2,4,5-T Ester	1000 ppm	Water	I-II	See 1949 Report	
FS	S	2,4-D / 2,4,5-T Esters 50-50	2 ppa	Water	II	Iowa	S&H
Oak, White & Red Mixed (Quercus spp.)							
DS/BS		Propylene et al. Esters 2,4,5-T	4 AHG	Fuel Oil	II	Mich.	LLC
DS/BS		" " "	16 AHG	F.Oil	II	Mich.	LLC
DS/BS		" " "	48 AHG	F.Oil	II	Mich.	LLC
DS/BS		Propylene et al. Esters 2,4-D	24 AHG	F. Oil	III	Mich.	LLC
DS/BS		" " "	16 AHG	F.Oil	III	Mich.	LLC
DS/BS		" " "	48 AHG	F.Oil	II	Mich.	LLC
Oak, Willow (Quercus phellos)							
CS-Frills	W,S	2,4,5-T Esters	1%	Water	II	SC	USFS
Osage Orange (Maclura pomifera)							
DS/BS		Propylene et al. Esters 2,4-D	48 AHG	F.Oil	III	Mich.	LLC
DS/BS		Propylene et al. Esters 2,4,5-T	16 AHG	F.Oil	II	Mich.	LLC
FS	Sp	2,4,5-T	1000 ppm 2000 ppm 4000 ppm	Water	II	Nebr.	NES-DEK
CS	W	2,4,5-T Ester	5%	L.Oil	I	Nebr.	NES-DEK

Type of Treatment	Seasons Applied	Chemicals Used: Chemical Formulations	Conc.	Diluent	Reaction type	State	Authority
CS	W	2,4-D / 2,4,5-T Ester	25%/ 25%	D. Oil	I	Nebr.	NES-DRK
CS	W	2,4-D Ester	5%	D. Oil	IV	Nebr.	NES-DRK
FS	S	2,4-D Esters	Var.	Water	IV	See 1949 Report	
FS	S	2,4-D / 2,4,5-T Esters	1000 ppm	Water	II	See 1949 Report	
FS	S	2,4,5-T Esters	Var.	Water	II	See 1949 Report	
Ozier, Red (Cornus stolonifera) (Also See Dogwood)							
FS	S	2,4,5-T Ester	4000 ppm	Water	II	See 1949 Report	
Pea, Siberian (Caragena arborescens)							
FS	Sp.	2,4-D Ester	8 oz.	Water	II	Sask.	HAF
Pear, Prickly (Opuntia spp.)							
FS	S	2,4-D Esters	-	Oil	III-IV	See 1949 Report	
FS	S	2,4,5-T Amine	1%	80% Oil	II	See 1949 Report	
Pear, Prickly (Opuntia lindheimeri)							
FS	Sp.S	2,4,5-T Ester	6000 ppm	Diesel	II	Texas	RAD
FS	Sp.S	2,4,5-T Ester / Na TCA	4000 ppm	25% D. Dsl.	II	Texas	RAD
FS	Sp.S	2,4,5-T Amine	3000 ppm	50% D. Dsl.	II	Texas	RAD
FS	Sp.S	2,4,5-T Ester	6000 ppm	50% D. Dsl.	II	Texas	RAD
FS	Sp.S	TCA Acid	5%	Diesel	III	Texas	RAD
Pear, Prickly (Opuntia numifosa)							
FS	Sp.S.F.	2,4,5-T Ester	20,000 ppm	Water & Oil	I	Okla.	EHM
Persimmon (Diospyros virginiana)							
FS	S	2,4-D / 2,4,5-T Esters	Var.	Water	II-III	See 1949 Report	
Pine, Eastern white (Pinus strobus)							
FS	S	2,4-D Esters	Var.	Water	III	See 1949 Report	
Pine, short-leaf (Pinus echinata)							
FS	S	2,4-D / 2,4,5-T Esters	Var.	Water	II-III	See 1949 Report	
Pine, Virginia (Pinus virginiana)							
FS	S	2,4-D / 2,4,5-T Esters	Var.	Water	I-III	See 1949 Report	
Plum, Wild (Prunus americana)							
FS	S	2,4-D Ester	2000 ppm	Water	II	See 1949 Report	
Plum, Wild (Prunus spp.)							
FS	S	2,4-D / 2,4,5-T Ester	6000 ppm	Water	I	See 1949 Report	
Poplar, White (Aspen) (Populus tremuloides)							
FS	S	2,4-D / 2,4,5-T Esters	1½ ppa	Water	I-II	Man.	HEW
BS	S	2,4-D Ester	8000 ppm	D.Oil	II	Mich.	MWD
BS	S	2,4,5-T Ester	8000 ppm	D.Oil	I	Mich.	MWD
BS	S	2,4-D / 2,4,5-T Esters	8000 ppm	D.Oil	I	Mich	MWD
Injec.	S	2,4,5-T Ester	8000 ppm	D.Oil	I	Mich.	MWD
FS	Early S	2,4-D Isop. Ester	1500 ppm	Water	II	Minn.	HLH
FS	Mid S	2,4-D Isop. Ester	1500 ppm	Water	III	Minn.	HLH
FS	Late S	2,4-D Isop. Ester	1500 ppm	Water	III	Minn.	HLH
FS	Early S	2,4,5-T Isop. Ester	3000 ppm	Water	III	Minn.	HLH
FS	Mid S	2,4,5-T Ester, Isop.	3000 ppm	Water	III	Minn.	HLH
FS	Late S	2,4,5-T Isop. Ester	3000 ppm	Water	III	Minn.	HLH
FS	Early S	2,4-D / 2,4,5-T Esters	3000 ppm	Water	II	Minn.	HLH
FS	Mid S	2,4-D / 2,4,5-T Esters	3000 ppm	Water	III	Minn.	HLH
FS	Late S	2,4-D / 2,4,5-T Esters	3000 ppm	Water	III	Minn.	HLH
FS	S	2,4-D Esters	Var.	Water	II-III	See 1949 Report	
DS	Dec.1949	2,4,5-T Ester	11 ppa	90-0;10-W	I	NJ	ACP Co.
DS	"	2,4-D / 2,4,5-T; 2/1	11 ppa	100 gal.O	I	NJ	ACP Co.

Type of Treatment	Seasons Applied	Chemical Formulation	Conc.	Diluent	Reaction type	State	Authority
Poplar, Yellow or Tulip (Liriodendron tulipifera)							
FS	S	2,4-D + 2,4,5-T Ester	6000 ppm	Water	I	See 1949 Report	
DS	S	2,4-D + 2,4,5-T, 2/1	11 ppa	100 gal. Oil	I	NJ	ACPCo.
Rabbit Brush (Chrysothamnus stenophyllus?)							
FS	S	2,4-D Ester and Amine	Var.	Water	IV	See 1949 Report	
Rabbit Brush, Small (Chrysothamnus depressus)							
FS	Sp.	2,4-D + 2,4,5-T Esters	1/2-3ppa	O&W	III	Wyo.	USFS
FS	S	2,4,5-T	Var.	Water	IV	See 1949 Report	
Redbud (Cercis canadensis)							
FS	S	2,4-D + 2,4,5-T Esters	Var.	Water	I-II	See 1949 Report	
Rose, Prairie (Rosa arkansana)							
FS	S	2,4,5-T	Var.	-	II	See 1949 Report	
Rose Macartney (Rosa bracteata)							
FS	S	2,4,5-T Ester	4000 ppm	5% D.Oil	II	Texas	WGM
FS	S	2,4-D Ester	1.25 ppa	20% D.Oil	II	Texas	WGM
FS	S	2,4-D + 2,4,5-T Ester	1.25 ppa	20% D.Oil	II	Texas	WGM
FS	S	2,4,5-T Ester	1.5 ppa	20% D.Oil	II	Texas	WGM
FS	S	2,4,5-T Amine	1.25 ppa	20% D.Oil	IV	Texas	WGM
Rose, Prairie (Rosa suffulta)							
FS	S	2,4-D Amines	Var.	Water	IV	See 1949 Report	
Rose, Wild (Rosa spp.)							
FS	LAte sp.	2,4-D Ester or Amine	1 ppa	Water	III	Sask.	HAF
FS	Late Sp.	2,4,5-T Ester	1 ppa	Water	II	Sask.	HAF
FS	S	2,4-D	1½ ppa	Water	IV	Man.	HEW
FS	S	2,4,5-T	1½ ppa	Water	I	Man.	HEW
FS	S	2,4-D Esters	Var.	Water	IV	See 1949 Report	
Sagebrush, Big (Artemisia tridentata)							
FS	Sp.	2,4-D + 2,4,5-T Esters	1/12 to 3 ppa	O&W	II	Wyo.	USFS
FS	S	2,4-D Esters & Amines	Var.	Water	II	See 1949 Report	
FS	S	2,4,5-T Esters	Var.	Water	II	See 1949 Report	
Sagebrush, Black (Artemisia arbuscula)							
FS	S	2,4-D Esters & Amines	Var.	Water	II	See 1949 Report	
FS	S	2,4,5-T Esters	Var.	Water	II	See 1949 Report	
Sagebrush, Sand (Artemisia filifolia)							
FS	Late S	2,4-D Ester	1 ppa	Oil	II	Nebr.	S&K
FS	Late S	2,4-D Amine	1 ppa	Water	II	Nebr.	S&K
Saltbush (Atriplex spp.)							
FS	S	2,4-D Esters & Salts	Var.	Water	I-II	See 1949 Report	
Sassafras (Sassafras albidum)							
FS	S	2,4-D Ester	1000 ppm	Water	II	See 1949 Report	
FS	S	2,4-D + 2,4,5-T Esters	Var.	Water	I	See 1949 Report	
Saskatoon (See Juneberry)							
Snowberry (Symphoricarpos alba)							
FS	Sp.	2,4-D Ester	1½ ppa	Water	I-II	Man.	HEW
Silverberry (Elaeagnus commutata)							
FS	Sp.	2,4-D Ester	1 ppa	Water	II	Sask.	HAF
FS	S	2,4-D Ester & Amine	Var.	Water	II	See 1949 Report	
Snowberry, Western (See Buckbrush)							
Spicebush (Benzoin aestivale)							
FS	S	2,4-D Esters	3000 ppm	Water	I-II	See 1949 Report	

Type of Treatment	Seasons Applied	Chemicals Used: Chemical Formulation	Conc., Diluent	Reaction type	State	Authority
Spruce (Picea glauca)						
FS	Sp.	2,4-D Ester	8 oz. Water	IV	Sask.	HAF
Sumac, Fragrant (Rhus aromatica)						
FS	S	2,4-D ∕ 2,4,5-T Esters	6000 ppm Water	I	See 1949 Report	
Sumac, Smooth (Rhus glabra)						
FS	S	2,4-D ∕ 2,4,5-T Ester	6000 ppm Water	I	See 1949 Report	
FS	S	2,4-D Ester	2 ppa Water	I	Iowa	S&H
FS	Sp.	2,4-D Ester	2 ppa Water	III	Iowa	S&H
Sumac, Staghorn (Rhus typhina)						
FS	S	2,4-D Esters	3000 ppm Water	I	See 1949 Report	
Sumac, (Rhus spp.)						
FS	Sp.S	2,4-D ∕ 2,4,5-T Ester	1 gal/A Water	I	PA	GHB
Sweet Bay (Magnolia virginiana)						
CS Cup	S	Amate	Dry Salt -	I	NJ	USFS
Sycamore (Plantanus occidentalis)						
FS	S	2,4-D Esters	3000 ppm Water	II	See 1949 Report	
FS	S	2,4-D ∕ 2,4,5-T Esters	Var. Water	I	See 1949 Report	
Tea-Labrador (Ledum groenlandicum)						
FS	S	2,4-D Butyl Ester	38,400 ppm Water	II	Minn.	USFS
FS	S	2,4,5-T Butyl Ester	38,400 ppm Water	II	Minn.	USFS
FS	S	2,4-D ∕ 2,4,5-T Butyl Ester	19,200 ∕ 34,400 ppm Water	II	Minn.	USFS
Tobacco Tree (Nicotiana glauca)						
FS	S	2,4-D Esters & Salts	2 ppm Water	I-II	See 1949 Report	
Tree of Heaven (Ailanthus altissima erythrocarpa)						
FS	S	2,4-D Esters	3000 ppm Water	I-II	See 1949 Report	
Walnut, black (Juglans nigra)						
FS	S	2,4-D Esters	3000 ppm Water	III-IV	See 1949 Report	
Walnut, white (Juglans cinerea)						
FS	S	2,4-D Esters	3000 ppm Water	II-III	See 1949 Report	
White Brush (Lippia ligustina)						
FS	F	2,4-D Ester	1.5ppa Water	IV	Texas	WGM
FS	F	2,4-D Amine	2.3 ppa Water	IV	Texas	WGM
FS	S	2,4-D Ester	1.25 ppa 25% Dies.	III	Texas	WGM
FS	S	2,4-D ∕ 2,4,5-T Est.	1.2 ppa 25% Dies.	III	Texas	WGM
FS	S	2,4,5-T Ester	1.25 ppa 25% Dies.	III	Texas	WGM
FS	S	2,4,5-T Amine	1.25 ppa 25% Dies.	III	Texas	WGM
DS	W	2,4-D Ester	3.0 ppa Diesel	III	Texas	WGM
DS	W	2,4,5-T Ester	4.5 ppa Diesel	III	Texas	WGM
DS	W	2,4-D ∕ 2,4,5-T Ester	3.7 ppa Diesel	III	Texas	WGM
CS	Sp.S.F.	2,4-D Ester	6000 ppm Diesel	II	Texas	WGM
CS	Sp.S.F.	2,4,5-T Ester	6000 ppm Diesel	II	Texas	WGM
Willow (Salix spp.)						
FS	S	2,4-D Ester	1½ ppa Water	I	Man.	HEW
FS	S	2,4-D Esters	Var. Water	I-II	See 1949 Report	
FS	S	2,4-D ∕ 2,4,5-T Esters	1000 ppm Water	I-II	See 1949 Report	
FS	S	2,4,5-T Esters	2000 ppm Water	I	See 1949 Report	
Willow, Black (Salix nigra)						
FS	S	2,4-D Ester	3000 ppm Water	I-II	See 1949 Report	
FS	S	2,4-D ∕ 2,4,5-T Esters	Var. Water	I	See 1949 Report	

Type of Treatment	Seasons Applied	Chemicals Used: Chemical Formulation	Conc.	Diluent	Reaction type	State	Authority
Willow Sandbar (*Salix longifolia*)							
CS	W	2,4-D / 2,4,5-T Ester 50-50	2 ppa	Oil	I	Iowa	S&H
FS	W,S-1	2,4-D / 2,4,5-T Ester 50-50	2 ppa	Water	I	Iowa	S&H
Witch Hazel (*Hamamelis virginiana*)							
FS	S	2,4-D / 2,4,5-T Esters	3000 ppm	Water	II	See 1949 Report	
Yucca (*Yucca glauca*)							
FS	Sp.S.F.	2,4,5-T Ester	20,000 ppm	W&O	II	Okla.	EHM
Yaupon (*Ilex vomitoria*)							
BS	S	2,4,5-T Ester	8000 ppm	Diesel	II	Texas	RAD
BS	S	2,4,5-T Amine	8000 ppm	50% Diesel Emulsion	IV	Texas	RAD

Project VII. Mechanical Considerations.

Mechanical Considerations R. A. Norton

Summary

The several abstracts dealing with mechanical considerations for weed control cover such a wide variety of topics that it is difficult to summarize the findings. This indicates the complexity and importance of the broad subjects of engineering and equipment for weed control, and serves to point out the need for further experimentation along these lines.

Rather than to attempt to combine the findings of the various research workers, the following categories of investigation are presented to guide the reader to abstracts that may be of interest:

Fertilizer placement for weed control (Collins, Norton)
Flame weeding (Johnson, Larson)
Harvesting equipment as carriers of weed seed (Hurlbut)
Laboratory tests on spray equipment (Larson)
Mechanical weeders, sugar beets (French)
Reduction of mechanical cultivation (Norton, et al.)
Sprayer operation - Injury to grain fields (Buchholtz)
Time studies (Lovely)

Abstracts of Results of Cooperators

Tractor injury as a factor in reducing grain yields when spraying weeds. Buchholtz, K. P. In 1947 a four wheel tractor with 10x28-inch rear tires was driven across plots of Vicland oats when the grain was 6, 12, 20 and 30 inches high with growth stages of seedling, tillering, booting and headed, respectively. The plots were seeded with a grain drill using a 6-inch spacing and four replicates were used. At maturity 4 quadrats, each consisting of 3 rows 10 feet long, were harvested across the wheel tracks in each of the treated plots. Check plots yielded 107 bu. per acre while the treated plots yielded 100, 103, 94 and 94 bus. per acre, respectively. None of the differences were statistically significant. In 1948 a similar experiment was conducted on Clinton oats with treatments being made at the 12, 20 and 30 inch stages. In this trial check plots yielded 68 bus. per acre with the treated plots yielding 62, 63 and 63 bus., respectively. Again the differences in yield are not significant but the tendency for reduced yields is the same. The average reduction in yield due to tractor injury on the 10 foot plots during this two-year period was 6.5, 6.7, 10.7 and 9.9 percent for the treatments made at the 6, 12, 20 and 30 inch growth stages. When using a conventional sprayer with a 20-foot boom it appears that yield reductions due to tractor injury would seldom be expected to exceed 6 percent even at the larger growth stages. At earlier growth stages the injury would be appreciably less. (Contribution of Department of Agronomy, University of Wisconsin, Madison, Wisconsin.)

Fertilizer attachment developed for lister-planter for corn. Collins, E.V. and Norton, R. A. On the basis that weed control may be introduced into the culture of a crop during any one of several operations throughout a crop season, an attempt was made to develop an improved lister-planter for corn. Previous experience has shown that hard-ground listing as primary preparation of land for corn is effective in reducing subsequent weed growth. Weed seeds that may be lying on the soil surface are buried in the ridges between rows. Later cultivation of listed

corn is very efficient in controlling weed growth. But growth of listed corn has been inhibited on some of the heavier soils because fertility is not readily available to the seedling corn plants at the bottom of lister furrows. Still no satisfactory fertilizer attachment has come into general use for lister-planters. Through development of a floating hitch and steering mechanism for a tractor-mounted lister corn planter it is now possible to control depth of seed placement regardless of the depth of lister furrows. The mechanism always runs level. Fertilizer is placed in an area closely adjacent to the hill of corn where the young plants can reach it easily. Because the fertilizer is confined to a small area it feeds the corn plants rather than the weeds. (Contribution of Dept. of Agri. Engineering, Iowa Agri. Exp. Sta. and Div. of Farm Mach., Bur. of Plant Ind., Soils, and Agri. Engr., USDA.)

Residual weed seed and grain in combines. Hurlbut, L. W. Depressions, ledges, and drapers are the common containers for residual weed seed and grain remaining in combines following harvest operations. Thorough cleaning of a five-foot combine following the 1949 harvest season on the University Farm yielded 12.4 pounds of residual materials consisting of 22 per cent grain and weed seed (16 kinds of seed), 12.9 per cent dust, and 65.1 per cent plant fiber. About 30 per cent of this material was inside the machine; 25 per cent was in the lower draper (draper was in fair condition); and 45 per cent was taken from miscellaneous external ledges. A similar check following the 1948 harvest season yielded 11 different kinds of seed and grain.

Correspondence with manufacturers' representatives indicates that they are generally aware of some improved construction features in combines which help to reduce the amount of residual material carried. Construction features commonly mentioned were, rounded surfaces, steep gravity chutes, and fewer and smaller ledges. However, replies to questions about facilities and procedures for cleaning the residual material from the internal parts of the combine cause us to believe that they do not realize how much time and effort must be expended to thoroughly clean a combine in accordance with the recommendations offered. Directions were followed in one case and it required about 4 hours to do a thorough job. In order for this to become a practical field job, the time requirement must be reduced to 4 or 5 minutes. (Contribution of University of Nebraska Agri. Exp. Sta.)

Sugar beet stand reducer and weeder. French, G. W. An experimental tractor-mounted rotating tined wheel type of thinner and weeder was constructed with two rotating units per row. These units rotate in opposite directions, thus producing a criss-cross pattern of scratches across the row. Provisions were made for varying the rotating speed relative to the forward speed of the tractor. The rotating elements were mounted in front of the tractor operator and driven from the power-take-off shaft. This machine was tested a limited amount for one season and it appears that under the right conditions a reduction of hand labor for weeding and thinning of sugar beets can be effected. Some factors affecting the results obtained are: (1) size of beets, (2) condition of soil in respect to moisture content and compaction, (3) velocity of tine impact with the soil, and (4) depth of tine penetration in the soil. (Contribution of USDA, Bur. of Plant Ind., Soils and Agri. Engr., Div. of Farm Machinery in cooperation with the Agri. Engr. Dept. of the Michigan Exp. Sta.)

Flame cultivation of field corn. Johnson, V. H. and Larson, R. E. Attempts are being made to adapt flame cultivation to the control of weeds in field corn. The burner, which is being used, is tractor-mounted and equipped with four generating type burners. It is a two-row machine utilizing two burners per row. The fuel

used is a liquified petroleum gas--propane--in a 110-gallon supply tank. At a temperature of 90° F. the pressure within the tank is near 160 psi. The liquid is taken from the bottom of the tank, runs through a pressure reducing valve and passes to the burners by means of a rubber hose.

The tests are not complete, but certain factors appear evident at present. These are: (1) The generating type burner is necessary to overcome the refrigeration effect in the supply tank, (2) the burners must be staggered such that one burner does not rob an opposite burner of its air supply and to avoid having flames meet at the row, resulting in ricocheting, (3) The angle of the burner with the ground is dependent upon the smoothness of the ground surface, (4) the burner is best operated at a pressure of 30 psi, which is enough to push the heat through the stand of weeds and yet stop it short of causing notable injury to corn in the adjacent row, (5) the flamer should not be used during the period when the corn is at a growth stage between emergence or 1" and 12" high, and (6) flame cultivation probably can, by itself, control weeds completely by proper timing and repeated operations, but for best results it appears that it should be used in conjunction with some shovel cultivation requiring fewer flame applications. (Contribution of Divisions of Agronomy and Agri. Engineering, University of Minnesota, and Div. of Farm Machinery, Bur. of Plant Ind., Soils, and Agri. Engineering, USDA.)

Corrosive action of new herbicides. Larson, R. E. Tests are in progress to determine corrosive action of new chemicals on all materials making up spraying equipment; including metals, hose and paints. Metals under test include stainless steel, plain and galvanized steel sheet, aluminum, copper, brass, and bronze. Hose tests include natural rubber, neoprene synthetic and vinylite plastic hose. Paints to be included have not been selected. Concentrations of chemical solutions used are similar to those recommended for field tests. Action of four chemicals on metals are reported as follows:

Maleic hydrazide - 1. No effect on aluminum, stainless steel nor iron strips. 2. Deteriorated galvanizing exposed to vapor and left a fine deposit on submerged section. 3. Bronze and copper were very clean on submerged section but some deposit was left on section that was wetted and dried alternately. 4. Brass had a fine scale on submerged section. 5. In general, submerged sections were affected little but wet and dry sections showed some deposit.

3-6 Endoxohexahydrophthalic acid (Me 3003, liquid form) - 1. Order of resistance is stainless steel, brass, copper, aluminum, bronze. 2. Galvanizing disappeared completely from submerged section, but a heavy, coarse deposit accumulated at surface level and in the wet and dry section. 3. Plain steel rusted badly below surface but had very little rust in wet and dry section. With the powder form (Me 3001): 1. Stainless steel showed no effects. 2. No other metals showed any action below the surface of the solution but heavy deposits accumulated in the wet and dry section. 3. Aluminum was corroded quite severely at surface point.

Aero cyanate (KOCN) - 1. Stainless steel, steel sheet, and aluminum showed no effects. Small rust spots appeared on plain steel but they were smaller than on steel in water. 2. There were very heavy deposits on brass, bronze, and copper in the wet-dry sections. (Contribution of Div. of Farm Machinery, Bur. of Plant Ind., Soils and Agri. Engr., USDA, and Div. of Agri. Engr., Univ. of Minnesota.)

Nozzle testing. Larson, R. E. Preliminary tests have been started to determine the accuracy of measuring nozzle volume distribution using a corrugated surface as a means of separating the portions of the sprayed area. The two stands

being compared are: (1) A test stand using standard corrugated aluminum sheeting for a surface. The corrugations and thus the separable portions of the distribution measure 2.7" o.c. The liquid in each corrugation is collected in a graduated cylinder. (2) The second stand has a fabricated aluminum surface. These fabricated corrugations measure 1" o.c., have V-shaped bottoms, and have vertical sides 1" high. These vertical sides should eliminate any inaccuracies due to splashing. The liquid in each corrugation is drained into its respective graduated test tube.

Tests have been made using a 65° fan-type nozzle rated at approximately 20 gallons per acre for standard spraying. The pressure was set at 30 psi, and the height adjusted by 2-inch intervals from 14 inches to 28 inches.

The results, so far, indicate the standard corrugated sheet stand is very inaccurate when the spraying is done at heights lower than 20 inches. The greatest error is in the portion of the sprayed area between the nozzles where the angle of incidence and velocity of the droplets combine to cause considerable splashing and consequent inaccurate widening of the indicated sprayed area for each nozzle. As the height is increased the angle of incidence and the velocity evidently change enough to reduce the splashing such that results of the two tests more nearly coincide. These results also indicate the size of nozzle and the pressure will have a bearing on the relationship of the two tests. (Contribution of Div. of Farm Machinery, Bur. of Plant Ind., Soils and Agri. Engr., USDA, and Division of Agri. Engr., Univ. of Minnesota.)

Time studies of weed sprayers. Lovely, Walter G. Preliminary time studies have been made on high clearance spray rigs to determine the efficiency of the machines operating under field conditions. Time studies were made on a home-made owner-operated custom spray rig, a home-made experimental spray rig operated by an inexperienced operator, a commercially built spray rig operated by an experienced operator.

The results, so far, indicate that there is a loss of efficiency due to poor sprayer design, inconvenient placement of supply tank, insufficient capacity of pump or hose used to fill sprayer, slowing down at end of rows, lack of conscientiousness on the part of the operator, and poor overall planning. These studies indicated that there was a loss of time at the ends of rows due to a slow shut-off and slow build-up of pressure. Studies are now underway to determine the value of quick shut-offs and rapid pressure build-ups.

The owner-operator doing custom spraying has redesigned his sprayer and also his supply tank several times to increase efficiency. The last study made indicated that he was spraying approximately 80% of the time spent in the field. The inexperienced operator was spraying approximately 42% of the time spent in the field. The experienced operator using a commercial spray rig was spraying approximately 54% of the time spent in the field. (Contribution of Div. of Farm Machinery, Bur. of Plant Ind., Soils, and Agri. Engineering, USDA, and Dept. of Agri. Engr., Iowa Agricultural Experiment Station.)

Pre-emergence herbicide applications to supplement mechanical cultivation of sweet corn. Norton, R. A., Collins, E. V. and Lana, E. P. Pre-emergence applications of amine salt solutions of 2,4-D were applied to plots of sweet corn in a randomized block experiment with eleven replications. Plots were cultivated only in one direction, thus simulating results that might be expected under contour culture. The six-row plots were 16 hills (42 inches c. to c.) in length and included five different varieties. Four rows were harvested. Rates of application of 2,4-D varied by half-pound increments from none to 2 pounds acid equivalent per acre inclusive, in about 10 gallons of water. The entire field received three cultivations, but all in one direction. Complete control of broadleafed weeds in

the rows was attained with 1 to 1-1/2 lbs. of 2,4-D. Grassy weeds were quite well controlled with 1-1/2 lbs. 2,4-D; completely with 2 lbs. The several varieties were harvested and weighed separately but the following yields are a composite of those from all varieties and are in tons per acre: Cultivated check - 3.05; 1/2 lb. 2,4-D/Acre - 3.07; 1 lb./Acre - 3.32; 1-1/2 lb./Acre - 3.36; and 2 lb./Acre 3.22 Tons. Among these average yields, increases over check of 0.17 T/A are significant statistically and increases of 0.23 T/A are highly significant. (Contribution of Div. of Farm Machinery, Bur. of Plant Ind., Soils, and Agri. Engineering, USDA, and Departments of Agricultural Engineering and Horticulture, Iowa Agricultural Exp. Sta.)

Reduction of mechanical cultivation of field corn through herbicide application. Norton, R. A., Collins, E. V., Staniforth, D. W. and Bakke, A. L. To determine the number of mechanical cultivations of corn that can be eliminated through application of herbicidal sprays at various times within the normal cultivation period, an experiment embodying eleven treatments and eight replications was conducted. Plots were 147 ft. long and 21 ft. (6 rows) wide. Four rows will be harvested but yields are not yet available. Check plots received the customary three mechanical cultivations, but no cross-cultivation. For further comparison, one plot in each block was hand-weeded besides receiving the three cultivations. Potential infestations of both broadleafed and grassy weeds were present as indicated by a study of plots where weed control was not complete. Control was quite satisfactory in the mechanically cultivated check plots and was, of course, complete where hand weeding was done. No material improvement in control was observed where post-emergence sprays of 1/2#/A 2,4-D acid equivalent, as amine salt solutions, were applied to substitute for or to supplement mechanical cultivation. On the other hand, pre-emergence applications of 2#/A 2,4-D followed by three mechanical cultivations gave weed control comparable to that in hand-weeded areas. A similar treatment, but with the normal first cultivation eliminated, showed a little better control than the check plot. With first and second cultivations eliminated, control was nearly as good as on the check plot. These results indicate the feasibility of elimination of the costly and time-consuming first cultivation of corn and the possibility that only the third or so-called lay-by cultivation may be necessary. This is especially important in contour culture where no cross-cultivation is possible and where tractor cultivators often damage stands of young corn by sliding on hillsides. (Contribution of Div. of Farm Machinery, Bur. of Plant Ind., Soils, and Agri. Engr., USDA, and Depts. of Agri. Engineering and Botany-Plant Path., Iowa Agri. Exp. Sta.)

Project VIII. Basic Problems.

Basic problems. W. E. Loomis, Department of Botany, Iowa State College, Ames, Iowa

Fundamental work on the absorption, translocation and toxicity of herbicides is still lagging behind the applied phases. The abstracts show progress, however, in each of these lines.

Absorption of leaf sprays is again shown by Iowa workers to be limited by physiological factors. A more rapid penetration of 2,4-D at higher temperatures is probably a partial explanation of the more rapid injury obtained from sprays made in warm weather. Effects of temperature on translocation and toxicity should be studied also. Volatility might contribute to penetration, although the available evidence suggests that its main result is dissipation of the chemical. Rainfall has important effects on the absorption of pre-emergence sprays by moving the active compounds deeper in the soil and by accelerating decomposition of such compounds as E.H.-1.

Translocation, in mesquite at least appears to be greater with lower dosages and with the more slowly toxic forms such as 2,4,5-T, suggesting that the phloem may function longer and more effectively with such compounds. The greater translocation at high temperature may be due to phloem action or to back-flow in the xylem with increased water stress here.

Work with both barley and corn emphasizes the importance of stage of development in relation to 2,4-D injury. It now seems clear that differentiating flower primordia are particularly susceptible to 2,4-D. With corn these can be avoided by waiting until the 12 to 14-leaf stage and by not spraying just before tassel and ear-shoot emergence. When small grain is stooling freely some tillers may be at the susceptible stage up to early stalk elongation. Antheses is a particularly susceptible stage in both plants, and the work reported from the University of Alberta helps to explain the reactions involved. Their prediction that irregularities in meiosis should result in genetic changes has not been demonstrated in Mr. Derscheid's work.

Studies of the effect of herbicides on soil micro-organisms represent a new approach which should be fruitful.

Work with Maleic Hydrazide at Ames suggests that this compound may be a better herbicide than growth regulant. While corn was detasseled, yield reductions were too severe to make the treatments employed of practical value.

Absorption of 2,4-D by leaves. Staniforth, D. W. and Bryan, A. H. Absorption of 2,4-D applied as leaf sprays or in droplets was separated from translocation effects by thorough washing at intervals after treatment to remove unabsorbed residues. Absorption was then measured in deformations of the plant and particularly in inhibition of new plumular growth.

The reactions of the absorption of 2,4-D across the cutin, cellulose and protoplasmic membranes of the leaf are not simple diffusion. When the plants were exposed to temperatures of 5 to 25°C. after treating and before

washing, the absorption, as measured by later injury, was approximately doubled by a temperature rise of 10° C. These results suggest that some type of chemical or enzymatic reaction was limiting absorption in these experiments.

Effective wetting agents greatly increased rates of absorption, and nonionic agents as a group appeared to be more effective than anionic. Triton B-1956, E.C. 5020, E.C. 5069, and Nonic 218 all gave increased penetration.

When 0.5 to 1.0 per cent of sucrose, glucose, fructose, lactose or manitol was added to a 2,4-D spray, injury was increased. Eight per cent of the same sugars caused hardening of the plants and reduced injury, possibly because of the hardening. Iowa Agricultural Experiment Station.

Observations on the comparative volatility of various 2,4-D formulations. Friesen, H. A. The propylene glycol butyl ether ester of 2,4-D (Dows H.1010 formulation of low volatile ester), the butyl ester and the triethonolamine amine of 2,4-D were used in a comparative test of volatility. The chemicals were used in their commercially formulated states as well as in mixtures with water, and placed in petri dishes under, but not touching young, rapidly growing tomato plants. The test was made in the open air but in a tree sheltered location.

The plants in the proximity of the low volatile ester had a noticeable swelling of the joints or nodes, but otherwise appeared normal and grew as rapidly as the untreated check plants. The amine and ester in their undiluted form resulted in a distortion of all the observable plant characteristics of the tomatoes. One month after exposure to the undiluted ester, the plants had turned yellow and died. Exposure to the undiluted amine resulted in very pale leaf color and the plants made no further growth. Volatility was most pronounced from the ester and amine diluted in water. Ester and water killed the plants within 14 days, while the amine in water distorted and killed the plants within 27 days after exposure. Contributed by the Dominion Experimental Station, Scott, Sask.

Effect of artificial rainfall on the toxicity of 2,4-D formulations used in pre-emergence weeding. Stein, P. R. and Staniforth, D. W. Soybeans, seeded at a depth of 1-1/2 inches, were used as the test crop. Four formulations of 2,4-D, triethylamine salt, butyl ester, acetamide and acetanalide (ACP 646-A) were applied as pre-emergence sprays on the same day of seeding at the rate of 3 lb./acre. Rainfall was simulated by spraying the soil surface with water, using a high gallonage sprayer. Four levels of watering were used: (1) Control (no water); (2) 1 inch of water on the day of spraying; (3) 1 inch of water on day of spraying and 1/2 inch two days later; (4) 1 inch of water on day of spraying, 1/2 inch two days later and 1/4 inch four days after spraying. The water was put on as fast as the soil would absorb it without run-off. Water-tight paper was spread over all plots to exclude normal rainfall, and removed when the beans began to emerge. Date of emergence, stand and size of plants were the criteria used in evaluating toxicity of the treatments. The formulations ranked; acetamalide, acetamide, ester and

amine, in order of increasing toxity. The amine caused up to 50% stand reduction while the acetamalide plots were comparable to the checks. The injury to the bean plants was greater with the larger amounts of water. In those plots which received no watering the formative effects on the beans were greatest with the acetanalide and least with the amine treatments. In a second experiment the amine salt and acetanalide formulations of 2,4-D were used. One inch of water was applied either 0, 1 or 2 days after spraying. The amine caused much greater injury than the acetanalide. Watering the day the treatments were made caused the greatest injury. Water applied 2 days after treatments caused the least injury. Iowa Agricultural Experiment Station.

Effect of rainfall on toxicity of pre-emergence herbicides used on soybeans. Staniforth, D. W., P. R. Stein and A. L. Bakke. Soybeans were seeded June 8 and pre-emergence treatments were made later the same day. The soil was dry on top at the time of treatment. Rainfall after treatment was 2.48 inches June 9, .35 inches June 12 and 2.67 inches June 16. The first beans emerged June 14. Treatments were as follows: butyl ester, triethylamine and acetanalide (ACP 646-A) of 2,4-D, at 1 and 2 lb./acre, dioctadecyl amine of 2,4-D at 2 lb./acre, Dow Premerge at 3 and 6 lb./acre, and E.H. #1 at 2 and 4 lb./acre. On June 12 the check plots were fully emerged, the acetanalide, Dow Premerge and dioctadecylamine treated plots were partly emerged, and the ester, amine and E.H. #1 treated plots were not emerged. Weed populations were reduced up to 60% by E.H. 1 at2 and 4 lb./acre, ester at 2 lb./acre, amine at 2 lb./acre, acetanalide at 1 and 2 lb./acre and Dow Premerge at 3 lb./acre, dioctadecylamine, and amine or ester at 1 lb. gave only fair weed control. After weed counts were made the plots were hand cultivated so that the remaining weed populations in the drilled rows were small. Notes taken on July 10 showed no significant reduction in height of soybean plants for the treatments with acetanalide of 2,4-D, dicotadecyl amine of 2,4-D and Dow Premerge. The other treatments reduced plant height by about 50%. Yield data showed no reduction in yield from acetanalide 1 and 2 lb./acre, dioctadecyl amine 2 lb./acre and Dow Premerge 3 and 6 lb./acre. Butyl ester at 1 lb. gave a slight reduction in yield, and all other treatments a statistically significant reduction. E.H. #1 at 4 lb. reduced stand of soybeans fully 50%. Iowa Agricultural Experiment Station.

Some factors affecting translocation of herbicides in mesquite. Young, Dale W., and Fisher, C. E. Stage of growth, temperature, type of chemical, and carrier used appear to be the main factors affecting translocation of herbicides in mesquite. Translocation of herbicides, as measured by the shield test, occurred from May 15 to August 15, 1949. The greatest amount of translocation occurred during the latter part of June, 78 days after the first leaves emerged in the spring. Temperatures above 80 degrees Fahrenheit for a period of 12 hours after treatment appeared to increase the distance of translocation. High humidity and low temperature after treatment appeared to retard translocation. Formulations of 2,4,5-T were superior to formulations of 2,4-D and mixtures of 2,4-D and 2,4,5-T. During ideal conditions the amine of 2,4,5-T translocated equally as well as the ester. With adequate coverage and ideal conditions water was equal to oil as a carrier of herbicides. However, certain low phytotoxic oils appear very

promising as carriers of 2,4,5-T. Contributed by the U. S. Bureau of Plant Industry, Soils, and Agricultural Engineering and the Texas Agricultural Experiment Station, Spur, Texas.

Physiological responses of barley when treated with 2,4-D at nine stages of growth. Dorscheid, Lyle A. Triplicate 4-row plots 14 feet long of an early variety, Plains, and a late variety, Wisconsin #38 in 1949 and Moore in 1950, were treated with the butyl ester of 2,4-D at the rate of one pound of acid equivalent per acre at Brookings, South Dakota in 1949 and at Ames, Iowa in 1950. Treatments were made at 3-day intervals. The first 1949 treatment was made when both varieties had five leaves and the last treatment was made when Plains but not Wisconsin #38 was starting to head. The first 1950 treatment was applied when both varieties had 4 leaves and Plains had one tiller, while the last application was made when awns of Plains were emerging from the boot and Moore had started to joint. In 1950 the yield of Plains was reduced approximately 10 bu/a by each of the first five treatments, which were applied when floral primordia were being laid down by either the main culm or one of the tillers, and by the 7th and 8th treatments which were applied during anthesis. The yield of Moore was reduced by the first 7 treatments, which were made while floral primordia were being laid down on the main culm or on one of the 1st two tillers, and again by the 9th treatment which was applied when the floral primordium was laid down on the 3rd tiller, and when Moore was approaching anthesis. The 1949 yields were reduced by treatments applied to Plains in anthesis and to Wisconsin #38 when the floral primordium was being laid down in the main culm. Floral primordia data were not obtained for the tillers in 1949, but since the leaf development and yields of 1949 followed the general trend of 1950, it is probable that the depressions came when floral primordia of tillers were being produced. Department of Agronomy, South Dakota Agricultural Experiment Station.

Cytological and physiological effects of 2,4-D applied to cereal grains at different stages of growth. Unrau, John and Corns, W. G. Olli barley, Stewart durum wheat and Thatcher common wheat were treated with 12 oz. 2,4-D acid equivalent ester formulation in 40 gal. water per acre applied to different plots at 3 day intervals from emergence to heading time. Each treatment was randomized in three replications, and samples were taken for cytological observations and yield and protein determinations. Unfortunately damage by birds has made the yield data unreliable, but cytological observations (to date only completed on barley), have revealed rather striking effects of the treatments. No irregularities at meiosis were caused by treatment at the first 3 dates, and little in dates 7 to 8 inclusive. Extreme meiotic irregularities were present in material sprayed on dates 4, 5 and 6, and some were also present in material from dates 9, 10 and later. Meiotic irregularities were particularly high in date 5 material, there being no plant where all microsporocytes were normal. The percentage of abnormal metaphases and anaphases ranged from 40.43 to 31.9 in the plants examined. No aberrations were found in the check material. The aberrations were of various types including aneuploidy, polyploidy, fragmentation, asynapsis, bridges, and in many cases, extreme chromosome stickiness. These results indicate that at certain stages 2,4-D can cause aberrations similar to those resulting from X-irradiation.

It appears very probable that the genetic consititution of plants affected by 2,4-D treatment may be changed. Progeny will be grown from the treated material to the second generation to determine whether or not observable mutations have occurred in any of this material. Protein analyses on mature barley seed have not shown differences associated with the observed stage differences in cytological behavior of pollen mother cells. Other analyses are in progress. Department Plant Science, University Alberta.

Responses of corn to 2,4-D. Rodgers, Earl G. Quadruplicate, 2-row plots, 35 hills long (1 foot spacing) of W22 and WF9 inbreds and W22 x M14 and WF9 x OS420 single crosses of corn were sprayed weekly with 1/2 pound and 1 pound of acid equivalent per acre of triethylamine salt of 2,4-D on eight dates beginning June 15 when the fourth leaf was expanded and ending July 31 at emergence of first tassels. Stalk breakage tests were made and stalk samples were collected from 4 plants per plot at breakage point 2, 5, 11, and 18 days after each treatment. Seed from self-pollinated plants treated at the 1 pound rate were germinated in a greenhouse sandbench to measure seed viability and seedling vigor. Yield data were obtained and analyzed statistically. Stalk brittleness was most pronounded in W22 and W22 x M14 at 5, 2, 11, and 18 days after treatment, respectively, particularly following third through sixth treatments at the one pound rate; WF9 and WF9 x OS420 developed little to no brittleness. Seed viability and seedling vigor of W22 was reduced by third, fourth, seventh, and eighth treatments. Yield of W22 was considerably reduced by treatments 2, 4, 5, 6, 7, and 8 at the one pound rate and by 8 at 1/2 pound rate, and that of W22 x M14 by 3 and 8 at the one pound rate and by 2 and 3 at the 1/2 pound rate. Stalk samples have not yet been studied and seed viability and seedling vigor studies have not been completed. Iowa Agricultural Experiment Station.

Effects of herbicides on soil micro-organisms. Kratochvil, D. E. Controlled experiments using the method outlined by R. T. Nelson, Journal of Agricultural Research, Vol. 68: 5: 222-237, were set up to determine by means of this simple technique the influence of several chemicals now being used as herbicides on soil microorganisms. This technique measures the amount of gas evolved through microactivity in soils treated with known amount of chemical and incubated under controlled temperature for fixed periods of time. Chemicals used were,2,4-D; 2,4,5-T; E.H. #1 (sodium 2,4-dichlorophenyl "Cellosolve sulphate"); E.H. #2 (dichloral urea); E.C. 3740 (disodium salt of 3,6-endoxy hexahydrophthalic acid); TCA (sodium trichloroacetate); PCP (pentachlorophenol); and IPC (isopropyl N-phenyl carbamate). One hundred gram samples of Barnes silt loam were used and chemical treatments made on the basis of pounds per acre. pH determinations were made on all treatments. Gas measurements were determined in centimeters of mercury displacement.

Results indicate little influence on either amount of gas evolved, or pH by the chemicals 2,4-D, 2,4,5-T, E.C. 3740, and E.H. #2. Sodium trichloroacetate, IPC and PCP showed marked influence on the activity of microorganisms. Sodium trichloroacetate at the rate of 150 pounds per acre stopped practically all activity. E.H. #1 gave an increase in activity which varied directly with

amount of chemical applied.

The pH of Barnes silt loam under normal conditions was found to be 6.4, after 48 hours of incubation it was 5.7. The pH of the chemically treated soil after 48 hours of incubation was: E.H. #1 - 5.72; E.H. #2 - 5.7; E.C. 3740 - 5.7; 2,4,5-T - 5.9; TCA - 6.0; PCP - 6.0, and IPC - 5.9. Chemicals that reduced bacterial activity as indicated by gas measurements brought about the least amount of change in the pH of the soil. South Dakota Agricultural Experiment Station.

Effect of maleic hydrazide on devils shoestring and quackgrass. Hoffman, O. L. and Sylwester, E. P. Maleic hydrazide applied at a rate of 4 pounds per acre killed a high percentage of knotweed, Polygonum aviculare. Testing on devils shoestring, Polygonum coccinium, was indicated by this response. Three different areas of devils shoestring were sprayed with 8 pounds of maleic hydrazide per acre. One was sprayed in 1949 and two others in 1950. The area sprayed in 1949 was completely eradicated. The kill on the plants sprayed in 1950 appears to be 98+%. Final data on the 1950 plots will not be available until next year. In the above areas the top growth was cut off a week to ten days after spraying. In two others where the top growth was not removed the kill was only 50% and 75%. It would appear that mowing in conjunction with maleic hydrazide spraying aided in obtaining better kills.

Spraying quackgrass, Agropyron repens, with 4 pounds per acre of maleic hydrazide on May 12 completely supressed seed production. The growing points of the quackgrass were killed in most cases. In a few plants a sterile head was produced. Further growth was stopped until cool fall weather. In many places the prevention of seed production on quackgrass is a satisfactory control. These plots were left undisturbed after spraying, and it seems probable that mowing or cultivation would have increased the effect of the chemical. Botany Department, Iowa State College.